THE ABILITY OF APHASIC ADULTS TO COMMUNICATE THROUGH DRAWING

By

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TABLE OF CONTENTS

Page

ACKNOWLEDGEMENTS ii

LIST OF TABLES v

ABSTRACT vi

CHAPTERS

I INTRODUCTION 1

Literature on the Syndromes of Adult Aphasia 2
  Theoretical Nature of Nonverbal Processing 3
  Studies of Nonverbal Communication Systems 5
  Studies of Drawing Ability 7
Statement of the Problem 15
Statement of the Purpose 16

II METHODS AND PROCEDURES 18

Experimental Subjects 18
  Criteria for Subject Selection 18
  Human Subjects Protection 19
  Description of Subjects 19
  Procedures 20
  Experimental Procedures 21

III RESULTS 25

Statistical Treatment 25
Comparison of the Control and the Aphasic Groups 27
  Action and Object Items Combined 27
  Action Items 28
  Object items 29
Comparison of the Three Aphasic Groups 30
  Action and Object Items Combined 31
  Action Items 32
  Object Items 32
Prediction of the CDT Visual Recognition Scores 33
Summary 35

IV CONCLUSIONS AND DISCUSSION 36

Conclusions and Discussions of Hypotheses 36
  Comparison of Control and Aphasic Groups....36
  Comparison Across Three Aphasic Groups 37
  Predictive Relationships....38
  Limitations 40
Observations Associated with the Study 41
Recommendations of Future Studies....44
Summary 47

REFERENCES 48

APPENDICES

A FORMS....52

B RAW DATA 58

C SAMPLE DRAWINGS PRODUCED BY SUBJECTS DURING CDT 71

BIOGRAPHICAL SKETCH....95

LIST OF TABLES

Table 1.1 SYMPTOMATOLOGY OF BROCA'S, WERNICKE'S, AND GLOBAL APHASIA 3

Table 1.2 SUMMARY OF APHASIC NONVERBAL COMMUNICATION STUDIES 5

Table 2.1 DESCRIPTION OF SAMPLE 20

Table 3.1 ADJUSTED MEANS AND STANDARD ERRORS OF CDT SCORES: ACTION AND OBJECT ITEMS COMBINED 27

Table 3.2 LEAST SQUARE MEANS TEST OF DIFFERENCE BETWEEN CONTROL AND APHASIC GROUPS: ACTION AND OBJECT ITEMS COMBINED 28

Table 3.3 ADJUSTED MEANS AND STANDARD ERRORS OF CDT SCORES: ACTION ITEMS 28

Table 3.4 LEAST SQUARE MEANS TEST OF DIFFERENCE BETWEEN CONTROL AND APHASIC GROUPS: ACTION ITEMS 29

Table 3.5 ADJUSTED MEANS AND STANDARD ERRORS OF CDT SCORES: OBJECT ITEMS 29

Table 3.6 LEAST SQUARE MEANS TEST OF DIFFERENCE BETWEEN CONTROL AND APHASIC GROUPS: OBJECT ITEMS 30

Table 3.7 LEAST SQUARE MEANS TEST OF DIFFERENCE AMONG APHASIC GROUPS: ACTION AND OBJECT ITEMS COMBINED 31

Table 3.8 LEAST SQUARE MEANS TEST OF DIFFERENCE AMONG APHASIC GROUPS: ACTION ITEMS 32

Table 3.9 LEAST SQUARE MEANS TEST OF DIFFERENCE AMONG APHASIC GROUPS: OBJECT ITEMS 32

Table 3.10 PREDICTING THE VISUAL RECOGNITION CDT SCORES FROM THE NINE INDEPENDENT VARIABLES: ACCOUNTED FOR VARIANCE AND STATISTICAL SIGNIFICANCE 34

Table 4.1 GLOBAL APHASICS: APHASIA QUOTIENT OF THE WESTERN APHASIA BATTERY (AQ WAB) AS PREDICTOR OF COMMUNICATIVE DRAWING TASK (CDT) PERFORMANCE 40

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The purposes of this study were: (a) to quantify the communicative effectiveness of aphasic adults' drawings, (b) to determine whether patients with different types of aphasia differ significantly in their ability to produce communicative drawings, and (c) to predict drawing effectiveness from standardized instruments.

Forty-two adult subjects with left cerebral vascular accident (CVA) brain damage and aphasia were selected from patients admitted to Tampa General Rehabilitation Center: fourteen Broca's, fourteen Wernicke's, and fourteen Global aphasics. Also, fourteen adult subjects with no history of CVA and aphasia were identified as control subjects. All subjects met the following selection criteria: right hand dominance, absence of professional drawing experience, absence of diffuse cortical damage, absence of dementia or psychosis, and ability to understand Communicative Drawing Task (CDT) instructions. The Western Aphasia Battery was administered to the aphasic subjects. In addition, the Rey-Osterrieth Complex Figure Test and the CDT were administered to all of the subjects. During administration of the CDT two decoders known to the subject, who were used only with one subject, served as judges of the subject's ability to produce drawings that were communicative. The CDT stimuli photographs--six training items, six object items, and six action items, were viewed by the subject but not by the decoders. The decoders independently wrote a word or phrase to describe their interpretations of the twelve concepts that the subject intended to communicate. Their interpretations of the drawings were scored by the examiner and Visual Recognition scores were generated.

The performance of the Control group was superior to the aphasic groups. The Global aphasic group was less proficient in communicating through drawing than either the Broca's or Wernicke's groups; however, no empirical differences existed between the Broca's and Wernicke's groups in their ability to communicate through drawing. The results of this study indicate that a Rey-Osterrieth score is a strong, single predictor of the CDT Visual Recognition scores for the the combination of object and action items and also for object items separately, but not for action items alone.

CHAPTER I
INTRODUCTION

Aphasic adults are impaired in their ability to interpret and formulate language symbols. Depending upon the type and severity of aphasia the adult may be trained during speech-language therapy to communicate more effectively using a verbal, nonverbal with verbal augment, or nonverbal system of communication. The nonverbal systems may or may not involve instrumentation. Nonverbal systems of communication that do not use instrumentation include manual signs, pantomime, writing and drawing.

Nonverbal communication systems may exist in the absence of language and may represent a more phylogentically primitive system (Feyereisen and Seron, 1982). For an adult suffering from aphasia, effective communication may depend on the use of spared language ability and on the capacity of the patient to exploit alternative modalities of communication such as nonverbal and nonlinguistic communication.

Drawing represents such a nonlinguistic system. It may be that visual images used as a communicative system are a type of expression separate from language; although it is evident that visual images are part of human thought processes (Lyon and Helm-Estabrooks, 1987). A language intact adult relies on a complex linguistic system that is more efficient for communication than any other means. However, for the aphasic adult, particularly the Globally aphasic adult, communication using this complex linguistic system may be impossible even with retraining. If this is the case, then drawing may become a viable alternative (Lyon and Helm-Estabrooks, 1987). Drawing perhaps taps the cognitive ideational processes that may be relatively intact even though the person has a severe linguistic deficit. The long-range goal of this line of inquiry is to test the efficacy of training aphasics to spontaneously communicate through drawing. One of the purposes of this study is to investigate the ability of aphasic adults to produce recognizable communicative visual images prior to drawing training. If drawing is to function as a comunicative modality, the aphasic adult must either evidence residual graphic skills or display an aptitude to train to acquire the skills (Lyon and Helm-Estabrooks, 1987).

There is a wealth of literature on the potential of aphasics to use verbal communication systems, but that literature does not provide information directly relevant to the focus of this study. A review of the literature reveals a body of information concerning the aphasic adult's ability to learn and use most forms of nonverbal communication. However, information is lacking on the adult aphasic's ability to use drawing as a communication system. An increase of information relative to the adult aphasic's ability to communicate through drawing could have significant clinical implications for the field of speech and language pathology.

Literature on the Syndromes of Adult Aphasia

Aphasia may be defined as an impairment in the ability to process language that affects clusters of decoding and response modalities, disproportionate to impairment of other intellectual functioning. Aphasia in adults is the result of an injury to the brain. In most cases, the brain injury that causes aphasia is a cerebrovascular accident (CVA). When an adult suffers a CVA a portion of his brain is deprived of its blood supply and, as a result, certain areas of brain tissue cease to function or die. For most adults the left hemisphere of the brain is the dominant hemisphere for speech and language abilities. Therefore, aphasia in adults is often due to a focal lesion in the left cerebral hemisphere.

Various speech-language symptomatology associated with the location of focal lesions have been described by aphasiologists at Boston Veterans Hospital and Boston University. The profile of these patterns is known as the Boston Classification System (Heilman and

Valenstein, 1979; Goodglass and Kaplan, 1983). The types of aphasia described in the Boston Classification System include Broca's, Wernicke's, Conduction, Transcortical Motor, Transcortical Sensory, Mixed Transcortical, Anomic, and Global. The variables used to determine the types of aphasia include the patient's spontaneous speech, auditory comprehension ability, paraphasic behavior, ability to repeat phrases, and naming ability. The three types of aphasia that are addressed in this study are Broca's, Wernicke's and Global aphasia. Table 1.1 describes the speech-language characteristics associated with each of the three aphasic types.

Table 1.1
SYMPTOMATOLOGY OF BROCA'S, WERNICKE'S, AND GLOBAL APHASIA

TYPE	SPONTANEOUS SPEECH	COMPREHENSION	PARAPHASIA	REPETITION	NAMING
Broca's	Nonfluent	Good	Uncommon	Poor	Poor
Wernicke's	Fluent	Poor	Common (verbal)	Poor	Poor
Global	Nonfluent	Poor	Variable	Poor	Poor

(Heilman and Valenstein, 1979; Goodglass and Kaplan, 1983)

As a result of their often complex language disorders, aphasic adults display disordered communicative abilities affecting a variety of modalities. Many aphasic adults are judged to be candidates for a nonverbal system of communication. The aphasic adult's verbal communication system may be more severely disordered than his nonverbal communication systems, but aphasia usually will affect his nonverbal communication systems to some degree. The process of training aphasic adults to use nonverbal systems of communication other than drawing has been studied. Yet, the feasibility of using drawing as a communication system with aphasic adults has been reported only to a limited exent.

Familiarity with information available on training aphasic adults to use other forms of nonverbal communication and on the adult aphasic patient's ability to draw is of some assistance in designing a study to determine the aphasic adult's ability to produce drawings that communicate. A review of this literature follows.

Theoretical Nature of Nonverbal Processing

Historically two theoretical positions have been espoused as to the processing and producing of nonverbal signals by aphasic adults. One position states that both verbal and nonverbal communication systems are linked. That is, aphasia results in an impairment to some central cognitive-symbolic process that manifests itself in parallel verbal and nonverbal communication dysfunctions. The second position posits that the verbal and the nonverbal communication systems are independent (i.e., they are mediated by different cerebral structures), and that the domain of aphasia is confined to verbal-linguistic processes. Feyereisen and Seron (1982), in their review of the nonverbal communication and aphasia literature, show that there is some empirical data to support both of these positions. While aphasics are impaired in the reception of nonverbal signals, they still retain some residual comprehension of nonverbal and nonlinguistic information. Feyereisen and Seron argue that the question is not to select one of the models exclusively, but to define with sufficient accuracy the valid claims of each position. They urge a differential approach in the analysis of processing and producing nonverbal signals that would interpret nonverbal communication as dependent on variables of context as well as situation and as a product of complex, interacting cognitive processes.

Although there are conflicting views in the literature as to the nature of the disorders underlying nonverbal communication, there is general agreement that aphasic patients are impaired to some extent in nonverbal communication (Herrmann, Reichle, and Lucius-Hoene, 1988). Never the less, a nonverbal system of communication may be a realistic alternative for some aphasic adults. Even though the presence of nonverbal communication deficits in the aphasic population is an accepted concept, nonverbal communication as a compensatory strategy for linguistic deficits has been recommended repeatedly (Herrmann, Reichle, and Lucius-Hoene, 1988).

Studies of Nonverbal Communication Systems

Researchers have studied various aphasic subpopulations. Their abilities have been described and compared to the nonaphasic population as well as to each other. In addition, researchers have examined the aphasics' ability to learn and use the following nonverbal communication systems: (a) alternative symbol system, i.e., identifying simple geometric forms that denote meaningful units (Gardner, Zurif, Berry, and Baker, 1976); (b) gesture (Cicone, Wapner, Foldi, Zurif, and Gardner, 1979); (c) manual signs (Coelho and Duffy, 1987); and (d) pantomime (Duffy, Duffy, and Mercaitis, 1984). Table 1.2 shows the types of nonverbal systems, the total number of subjects, and number of subjects in each group for these studies.

Table 1.2
SUMMARY OF APHASIC NONVERBAL COMMUNICATION STUDIES

	GARDNER ET AL.	CICONE ET AL.	COELHO ET AL.	DUFFY ET AL.
Type of Nonverbal Systems	Alternative Symbols	Gestures	Manual Signs	Pantomime
Number of Subjects	5	8	12	6
Type of Subjects	Global (3)* Broca's (1) Wernicke's (1)	Broca's (2) Wernicke's (2) Controls (4)	Nonfluent (12)	Broca's (1) Wernicke's (1) Controls (4)

* Information in the parentheses indicates the number of subjects

The training procedures of the alternative symbol system studied in the Gardner et al. (1976) research included two levels. Subjects were trained to respond to commands, answer questions, describe actions (Level 1), and spontaneously express desires and feelings (Level 2). The stimuli throughout the study consisted of a series of index cards on which were drawn simple geometric forms denoting meaningful units. For example, a subject could point to a square to communicate hunger. Performance of the subjects using this nonverbal system to communicate far surpassed their performance on parallel verbal tasks. Severely aphasic patients learned an alternative symbol system with which they spontaneously communicated, and they used at least some of the cognitive operations entailed in natural language.

An interview approach was utilized during the Cicone et al. (1979) study. During the interviews, topics were introduced in an attempt to elicit gestures from the subjects. Videotapes of the subjects were viewed by the examiners, and the subjects' behaviors were scored as to the quantity and quality of the gestures used. Cicone et al. found the gestures of the aphasics closely paralleled their speech output. Broca's aphasics produced simple unelaborated gestures. Wernicke's aphasics produced a considerable quantity of gesture, much of which was elaborated, complex, and often vague.

Subjects participated in a training program for the acquisition of a vocabulary of 37 manual signs during the Coelho et al. (1987) study. They progressed through three levels: imitation, recognition, and production. One trainer was used throughout the study who evaluated videotapes of the sessions. It was determined that a strong relationship exists between severity of aphasia and success in acquiring a vocabulary of manual signs. Also, there appears to be a threshold of severity below which the ability to acquire sign production is negligible.

Duffy et al. (1975) evaluated the skill of two aphasic subjects (one fluent and the other nonfluent) in the area of pantomime. The examiner presented the subjects with pictures in an attempt to elicit pantomime behaviors. Their behaviors were videotaped and analyzed by a different naive observer for each subject. The results show both aphasic subjects were seriously impaired in the accuracy of their pantomimic communication. The fluent aphasic subject pantomimed abundantly and often tangentually. The nonfluent aphasic subject delayed initiation of responses and would ultimately make brief, unelaborated responses.

In summary, a variety of nonverbal communication systems have been assessed as to their usefulness by aphasic adults. Relative to the above nonverbal systems, various aphasic subpopulations use these modalities although their abilities are depressed when compared to the nonaphasic population. Clinically, the alternative communication systems are considered viable options when retraining the communication structure of adult aphasics. In addition, there are data to show that aphasics use nonverbal behavior in natural conversational settings as a means of compensation for their verbal deficits (Herrmann et al., 1988). They concluded that when aphasics attempt to communicate, they switch from one severely impaired channel of communication to one less affected. The researchers recommended that rehabilitation of aphasic patients should take into account these nonverbal strategies that are spontaneously used and include the strategies in communication therapy.

Studies of Drawing Ability

Five areas of study can be found in the literature which are concerned with the association of drawing ability and neurological damage from a CVA. They include investigations of the site of lesion associated with drawing behavior, the residual artistic ability of trained artists, the ability of aphasic patients to copy shapes from memory, the spontaneous use of drawing for communication, and the effects of training on subjects to communicate through drawing. However, only seven of these studies were related to drawing as a medium for communication, and the number of aphasic adults used as subjects in these studies have been limited. Therefore, to date little is known about the capacity of the aphasic adult in this area.

Those researchers studying drawing have been concerned primarily with correlating the site of lesion of subjects with their resultant types of drawing disorders. This type of research has provided a list of drawing characteristics displayed by right hemisphere brain damaged and left hemisphere brain damaged adults.

Several researchers have examined the drawing characteristics displayed by right hemisphere damaged patients. Right hemisphere brain damaged patient's often (a) omit the whole left half of the drawing due to visual neglect (Gainotti, Messerli, and Tissot, 1972); (b) evidence poor spatial orientation (Kimsun and Faust, 1984); and (c) evidence faulty three-dimensional perspective (Gasparrini, Shealy, and Walters, 1980).

Left hemisphere damaged patients have a somewhat different profile. They often (a) omit segments of the right half of the drawing due to visual neglect (Gainotti, Messerli, and Tissot, 1972); (b) accurately draw an overall graphic form, although the form is significantly reduced in size (Gasparrini, Shealy, and Walters, 1980); (c) produce drawings lacking in detail (Kimsun and Faust, 1984); and (d) produce drawings confined to the upper left quadrant of the page (Larrabee and Kane, 1983).

Another area of study deals with the residual artistic ability of the trained artist who suffers a stroke. Three articles are available: two of them used the case study approach and one reviewed the literature.

The principle purpose of each case study was to increase knowledge of left hemispheric functioning as it relates to visual processing. The results were consistent. Alajouanine (1948) presented a case study of a noted French artist from the contemporary school. He suffered a stroke at the age of 52, resulting in Wernicke's aphasia. Pillon, Signoret, Van Eeckhout, and Lhermitte (1980) studied a satirist-caricaturist who suffered a stroke resulting in aphasia. The type of aphasia was described as both motor and sensory with right hemiplegia. The information provided in both case studies covered several years. Both subjects had a return of function as artists, but there were some residual deficits. Gardner and Winner (1981) reviewed the effects of left and right hemisphere damage on a variety of artistic modalities, such as music and the visual arts. They reported a 1974 study by Jung that could not be found. It described two German expressionists who suffered significant right hemisphere strokes. After recovery the artists continued to exhibit severe disorders of their artistic productions. They also reported on the two studies of left hemisphere damage described above, and they agreed with the conclusions of Alajouanine (1948) and Pillon et al. (1980). The artists with left hemisphere brain damage retained their premorbid drawing ability, whereas, the ones with right hemisphere brain damage did not. A further conclusion was drawn as to the differential effects of left hemisphere damage on trained and untrained visual artists. Contrary to the trained artist, the untrained individual showed significant drawing deficits. They concluded that overlearning of drawing by the professional accounts for his ability to retain drawing skills after incurring left hemispheric damage.

Gainotti, Silveri, Villa, and Caltagirone (1983) addressed drawing as it relates to language. However, they did not look at the interactive or communicative aspects of the aphasic patient's drawings. Instead they were concerned with aphasic subjects and their ability to reproduce line drawings from memory. Patients diagnosed as presenting with Broca's, Conduction, Wernicke's, and Anomic aphasia were studied. Subjects included 57 aphasics, 67 right CVA patients, 44 left CVA nonaphasic patients, and 23 normal control subjects. The findings of this study were as follows: (a) the aphasic patients' ability to draw from memory was far more disordered than the control group's ability; and (b) there was a significant correlation between the aphasic patients' disordered drawing from memory ability and their semantic-lexical deficits (the more severe the subjects' semantic-lexical deficits, the more impaired the subjects' ability to draw from memory).

Hatfield and Zangwell (1974) published a case study that reported one aphasic patient's ability to communicate using drawing. The study supplied information that indicated drawing might be an effective communicative modality for aphasic patients. The subject was a 26-year-old male who suffered a left middle cerebral artery occlusion resulting in nonfluent aphasia and right hemiparesis. During this subject's course of speech-language treatment, goals were directed toward training the patient to produce single words to communicate. He was not taught to communicate through drawing. Nevertheless, during functional communication, the patient preferred to communicate using a combination of gestures, writing, and drawing. The patient's communicative ability in this area was not measured objectively but was subjectively judged to be communicative by the researchers. Hatfield and Zangwell (1974) evaluated the patient's drawing skills and concluded that he was able to use drawing as a means to communicate ideas.

Some other published investigations describe the training of adult aphasics to use drawing as a means of communication. Subsequent to the 1980 article by Pillon et al., deLorant and Eeckhout (1980) published further information about the same artist. It was a further account of the use of drawing to facilitate and rehabilitate the patient's communicative abilities. Sabadel, the subject, was described as though he presented with nonfluent aphasia (e.g., lacking the verbal ability to produce even simple words). Soon after his stroke he evidenced the ability to copy and draw from memory simple objects with his nondominant hand. The researchers described the shaping and elaboration of Sabadel's residual ability during the rehabilitation communication training process. At the end of the treatment procedure, the patient was able to spontaneously produce drawings of complex concepts (agent, action, and object) with complex themes, as well as depicting emotions. He developed functional communication skill through drawing. This was, then, an instance of considerable success with a subject who was an artist prior to becoming aphasic.

Lyon and Sims conducted three studies (1984, 1986, and 1988). The 1984 study is very briefly summarized in an article by Lyon and Helm-Estabrooks (1987). It included two "expressively restricted" aphasics (probably Broca's patients). The subjects were taught to draw objects, actions, or sequential events by imitating the drawing behavior of the trainer.

When the subject could successfully imitate drawings, the trainer would draw an item, the subject would imitate, and then the subject would draw the item with a delay from one hour to several days. Drawings of objects and actions improved "substantially, whereas smaller gains were made in the depiction of sequential events." At the conclusion of the study, both subjects were able to communicate to naive receivers more than 90 per cent of the time. The 1986 study also is summarized very briefly in the Lyon and Helm-Estabrooks article (1987). It included five "expressively restricted" aphasics (ERA). The ERA group was evaluated using the Porch Index of Communicative Ability and an experimental 50-item drawing test. The experimental test consists of copying 10 geometric forms and objects, and drawing from memory 40 items--objects, actions, emotions, short sequential events, long sequential events, answers to wh-questions, and solutions to common problems of every day living. The pretreatment scores indicated that the aphasic subjects communicated more accurately to naive receivers when drawing than when using speech, gestures, and writing. After the three-month training program, aphasic subjects were even more proficient in drawing. Also, significant gain scores were obtained on the PICA. The final study by Lyon and Sims was reported at the 1988 Clinical Aphasiology Conference. The subjects were eight moderate to severe Broca's patients (average age was 61 years), and eight normal, artistically naive subjects (average age was 65 years). The aphasic subjects had completed traditional language therapy training; however, they remained functionally noncommunicative. Volunteers used line drawings and wh-questions as stimuli to interact with the aphasic subjects during treatment sessions. A modification of the Promoting Aphasics Communicative Effectiveness protocol (Davis and Wilcox, 1981) was used over a period of three years. The subjects were trained to enhance the communicative nature of their drawings by utilizing four strategies: (a) increasing the context information; (b) identifying which part of the drawing was important; (c) enlarging the important part of the drawing; and (d) demonstrating the use of the items drawn. They were tested both before and after the training period. Tests included nonstandardized limb apraxia and drawing assessments, the Porch Index of Communicative Ability, the Boston Diagnostic Aphasia Examination, the Peabody Picture Vocabulary Test, and the Weschler Adult Intelligence Scale. The communicative effectiveness of the subjects' drawings was evaluated by a research assistant who was not present during the actual training sessions. Two rating scales were used to quantify the communicative ability of the subjects: an eight-point scale addressing communicative effectiveness, and a four-point scale addressing ease of recognition. When communication was restricted to drawing only, the aphasic subjects achieved 88 per cent of the communicative effectiveness scores attained by the control group. Lyon and Sims concluded that (a) merely introducing the drawing modality into the subjects' pretreatment communication repertoire significantly improves the amount and accuracy of information the patient is able to convey, and (b) additional communicative gains can be noted after completion of three months of a treatment program.

Lyon and Helm-Estabrooks (1987) and Lyon and Sims (1988) briefly summarized a study by Morgan and Helm-Estabrooks (1987) on training aphasics to communicate through drawing. It included two "expressively restricted" aphasics. A base line of drawing skill was established by having the subjects draw a number of one-, two-, and three-part "accidents of daily living" which were pantomimed by the clinician. During the training mode, subjects were instructed through copying, demonstration, and verbal directions to produce one-, two-, and three-panel cartoons. To illustrate a three-part event, the clinician pantomimed writing with a pencil, breaking the point, and sharpening it. After training was complete, the subjects were asked again to draw the series of accidents of daily living. Of the posttreatment drawings, 75 per cent of them were superior to the pretreatment productions.

Trupe (1986) trained three types of aphasics (Broca's, Wernicke's, and Global) to communicate through drawing. There were five subjects in each group. The treatment involved modification of the Visual Action Therapy (Helm-Estabrooks, Fitzpatrick, and Barresi, 1982) and Promoting Aphasics Communicative Effectiveness (PACE) protocols. The sequence of the modified version of the VAT training protocol was: (a) tracing; (b) matching pictures with pictures; (c) matching objects with pictures; (d) imitating drawings; (e) independently producing drawings in response to object presentation; and (f) constructing a drawing of an object when it was not visually present. In an attempt to teach the communication of concrete and abstract ideas, the content varied among simple drawings of simple concepts, complex drawings of complex concepts, and simple drawings of complex concepts. In the PACE protocol, the clinician modeled drawing behaviors as a sender, and reinforced attempted communication of the aphasics as a receiver. After the aphasic subjects became functional communicators, family and other clinical staff acted as communication partners during therapy. Trupe, when studing the drawing of aphasic patients, drew a parallel between Gardner's (1983) stages of normal symbolic development and redevelopment of symbolization. Even though all of the subjects learned to effectively represent concepts, the level of symbolization varied among them. If they moved beyond the literal stage, communication in an interactive style was accomplished. Of the three groups, the higher performance of drawing to communicate was achieved among the Broca's patients. Subjects who did not recover speech became more effective in drawing to communicate than those who did recover speech. Trupe attributes this result to the fact that there was a greater need to use drawing by those who did not recover speech.

Yedor and Kearns (1987) studied a Broca's patient who was a left-handed 63-year-old male. The stimuli were line drawings. He was asked "to draw about the picture, or what it reminded him of." The instructions were intended to keep the subject from merely copying the drawing. There were three classes of content to transmit: activities of daily living (ADL), sports, and generalization "probe" items (familiar but untrained items). The training pattern consisted of five one-hour sessions of one class of stimuli followed by two one-hour generalization probe sessions until the subject met a predetermined criteria of functional communication of his intent. The subject was trained to criteria on the set of ADL drawings before the sports items were introduced. Also, there was one clinician who trained the subject and another clinician who was used to test whether or not the communicative behavior generalized to someone else. Response Elaboration Training was used throughout the study. The training clinician encouraged the subject to elaborate on his drawings by asking wh-questions and providing feedback. Yedor and Kearns found (a) the number of elements represented in the subjects' drawings increased (this was considered indicative of the level of functional communication), and (b) these drawing skills were generalizable to untrained but familiar stimuli by the end of the study, but attempts to elicit generalization of drawing behavior in spontaneous situations were unsuccessful. In an attempt to accomplish the latter, additional training was conducted. A tape of five minutes of a news broadcast was viewed by the patient and the training clinician. It was used as a basis for interactive communication between them. Again, Response Elaboration Training techniques were used. After 27 treatment sessions, the subject was able to respond successfully to open-ended questions about the news broadcast. With 21 additional training sessions, he was able to generalize this behavior to a clinician other than the trainer. Informal observations during lunch indicated he generalized communication through drawing to his everyday environment.

In summary, the number of subjects in the training studies is small; only a total of 32 aphasic subjects participated in the seven training studies. The types of aphasia studied include only Broca's, Wernicke's, Global, and a nonspecific class called Expressively Restricted Aphasics. Therefore, relatively little is known about how to train aphasics efficiently and effectively, and which kind of training might be most efficacious with different types of aphasia. The variety of training approaches and differing content resulting in positive outcomes indicate that drawing to communicate is a viable line of inquiry.

Statement of the Problem

The aphasic adult's ability to communicate verbally is always impaired, and the nature and degree of impairment varies with the type and severity of the aphasia suffered by the patient. For many aphasic adults, functional communication is possible only through training them to use some alternative or augmentative form of communication. For some adult aphasic patients, however, the nonverbal training options traditionally considered appropriate are often ineffective. Therefore, a more nonlinguist system such as drawing may be a practical communicative alternative for some patients.

A review of the literature reveals that the ability of aphasic adults to communicate through drawing has been studied only to a limited degree. Further, no information is available that would predict the potential of the various types of aphasic patients to draw to communicate. Nevertheless, speech-language pathologists, such as N. Helm-Estabrooks (personal communication, March 1985) at the Boston Medical Center and J. Lyon (personal communication, March 1985 and July 1988) at the Reno Veterans Administration Medical Center, urged the study of drawing as a means of communication by aphasic adults. Helm-Estabrooks has found some efficacy in drawing within the framework of the system known as Visual Action Therapy (VAT). Helm-Estabrooks et al. (1982) described the incorporation of drawing as the first of twelve steps during implementation of the VAT with Global aphasic patients. These clinicians offer the theory that the obstacles of severe auditory and reading comprehension disturbances, which are present when working with global aphasic patients, may be circumvented in one of two ways: (a) through the use of pictorial representations of messages; and (b) through the use of pantomime to facilitate comprehension of instructions. Hatfield and Zangwell (1974) concluded that their aphasic subject was able to draw to communicate because in all probability his ideational or cognitive processes were at least somewhat intact despite his linguistic deficits.

There are certain advantages for both the sender and receiver of messages if aphasics can use drawings to communicate. Like the nonverbal communication system of simple gesturing, drawing is a natural modality that the adult aphasic patient will have experienced premorbidly to some degree. This prior experience might shorten the learning curve. In addition, it is a system that is intrinsically iconic and therefore should be communicative to the majority of the untrained individuals in the aphasic adult's environment. However, a number of important questions remain unanswered by the literature. Are the drawings produced by aphasic adults "readable"? Are they interpretable by naive, uninformed observers? Other nonverbal communication systems, both unaided (e.g., Amerind) and aided (e.g., Phonic Ear VOIS instrument), are modalities that the adult aphasic patient in all probability will not have experienced premorbidly. These systems also require training on the part of the receiver for accurate interpretation. Also, it is possible specific types of aphasic patients may have more or less potential to learn and use drawing as opposed to other systems. Is there a subset of aphasic adults, perhaps within each of the different types of aphasias, that can produce interpretable drawings? Of particular interest is the possibility that there is a group of Globally aphasic adults who would be able to produce drawings which are decodable. If indeed these groups of aphasic adults exist, how are they to be identified? It is questionable as to whether the current standardized instruments measure this nonlinguistic skill. In all probability, these instruments do not measure the aphasic adult's spared ability to select salient concept features from stimulus photographs and to produce recognizable renderings while using them as models.

Statement of the Purpose

In light of the fact that very few investigators have examined the potential communicative abilities of aphasic patients through drawing, this study was designed (a) to quantify their ability to produce recognizable, communicative visual images prior to drawing training, (b) to determine whether patients with different types of aphasia differ significantly in their ability to produce drawings using a visual model, and (c) to predict drawing effectiveness from standardized instruments.

Specifically, the following hypotheses were addressed:

1. The aphasic subjects will evidence a depressed ability to produce recognizable drawings as compared to the control group.
2. The three groups of aphasic patients (Broca's, Wernicke's, and Global) will perform differently from each other in their ability to produce recognizable drawings. It was expected that Broca's patients would be more successful than Wernicke's patients when drawing to communicate object stimulus items. Also, it was expected that Wernicke's patients would be more successful than the Broca's patients when drawing to communicate action stimulus items.
3. Some combination of the nine independent variables including age, ability to repeat phrases, naming ability, speech information content, Aphasia Quotient (A.Q.), score on WAB drawing subtest, months post onset of CVA, Rey-Osterrieth score, and number of demonstration items needed to train for CDT will predict the Visual Recognition scores of the aphasic patients on the Communicative Drawing Task (CDT).

CHAPTER II
METHODS AND PROCEDURES

The ability of aphasic patients to produce recognizable visual images that were communicative to uninformed decoders was the focus of this study. Three subgroups of aphasic patients were compared to each other and to a nonaphasic control group. Also, combinations of the independent variables were examined as possible predictors of the performance of the aphasia subjects.

Experimental Subjects

Experimental subjects were patients who had suffered cerebral vascular accident (CVA) damage to the left hemisphere resulting in Broca's, Wernicke's or Global aphasia. A CVA is a neurologic disorder caused by pathologic changes in the extracranial or intracranial blood vessels, primarily due to atherosclerosis, thrombosis, embolic episodes, hemorrhage or by arterial hypertension. Cerebral infarction or necrosis of brain tissue may occur in the affected region. The stroke is usually recognized by a rather sudden loss of consciousness and other marked neurologic insult (Chusid, 1979).

Criteria for Subject Selection

Forty-two subjects were selected from the pool of patients admitted to Tampa General Rehabilitation Center (TGRC) between March 1986 and June 1987. From the patients admitted, the subjects were selected who met the following seven criteria:

1. The patients exhibited a left CVA resulting in Broca's, Global, or Wernicke's aphasia.
2. The patients exhibited right hand dominance.
3. The patients exhibited an absence of diffuse cortical damage.
4. The patients exhibited an absence of premorbid dementia or psychosis.
5. The patients exhibited an absence of psychotic reaction secondary to the CVA.
6. The patients exhibited an absence of professional drawing or drafting history (Pillon et al., 1980; and Alajouanine, 1948).
7. The patients understood the instructions sufficiently to respond to the CDT. Of all the patients examined with the six CDT sample photographs for possible inclusion in the study, one of them did not understand the task, and another one refused to continue the task.

Human Subjects Protection

The Tampa General Hospital Human Subjects Review Board and the University of Florida Human Subjects Review Board approved the design of the study. The Tampa General Hospital Board gave permission to conduct the study within their facility. The subjects, or their families if necessary, signed a consent form indicating their willingness to participate.

Description of Subjects

Forty-two adult subjects with left CVA brain damage and aphasia were identified. The aphasic subjects fell into three diagnostic categories: (a) fourteen subjects presented with Broca's aphasia, (b) fourteen subjects presented with Wernicke's aphasia, (c) fourteen subjects presented with Global aphasia. The age range of the aphasic subjects was between nineteen and ninety-two years of age. The range of months post CVA onset within the group of aphasic subjects was from one month through fifty-eight months. In addition, fourteen adult subjects with no history of CVA, aphasia, or drawing/drafting experience were identified as control subjects. The age range of the control subjects was from twenty-four through seventy-four years. The control subjects were right-handed and had no history of psychosis. Table 2.1 summarizes these data.

Table 2.1
DESCRIPTION OF SAMPLE

	BROCA'S	GLOBAL	WERNICKE'S	CONTROL
Number of Subjects	14	14	14	14
Male	6	8	5	4
Female	8	6	9	10
Mean Age in Years	49.9	70.4	60.6	45.8
Mean Months Post Onset	18.5	2.3	4.1	—

Procedures

Two standardized instruments and a nonstandardized one were used in this study. The Western Aphasia Battery (Kertesz, 1982) was administered to the adult left CVA aphasic subjects for several reasons. First, the Western Aphasia Battery (WAB) was used to identify the aphasic patients as Broca's, Wernicke's, or Global aphasics as defined by the Boston Classification System. Second, the WAB was used to measure the aphasic subjects' fluency of speech, ability to comprehend, ability to repeat phrases, ability to name, and ability to produce meaningful speech (information content). The severity of the subjects' aphasia was determined based on the above information. The WAB Aphasia Quotient (A.Q.) was used to denote the severity of the aphasia. It was not administered to the control subjects.

The Rey-Osterrieth Complex Figure Test (Lezak, 1976) was administered to both experimental and control subjects to obtain standardized scores indicating their visual perceptual organization skills or abilities. Each subject drew a complex figure on a blank sheet of paper while the visual representation of the figure was in view as a model. The examiner handed the subject a different colored pencil to complete each section of the drawing. The memory component of the Rey-Osterrieth Figure Test was eliminated, as the subjects' ability to draw from memory was not relevant to this study. The time it took the subjects to draw the complex figure was recorded. The subjects' drawing of the various elements of the Rey-Osterrieth figure was evaluated and an appropriate score was assigned. The range of possible scores is from zero through 36.

The Communicative Drawing Task (CDT) was developed by the investigator to examine the aphasic adult's ability to draw visual representations that communicate information to observers. The stimuli used in the CDT consisted of twelve color photographs, approximately 9 inches by 7 inches, which depicted six objects (nouns) and six actions (verbs). The noun stimuli were: DLM#632-293, sailboat; DLM#632-237, pair of scissors; DLM#632-282, bicycle; DLM#2610-300, alarm clock; DLM#632-285, car; and DLM#632-43, boy's face; the verb stimuli were: DLM#6410-101, boy washing a car; DLM#6410-172, boy blowing a horn; DLM#6410-67, woman seated at a table drinking a glass of juice; DLM#6410-180, girl talking on a pay phone; and DLM#6410-108, five men playing basketball. The photographs were selected from the All Purpose Photo Library--Set II (Developmental Learning Materials, 1980).

Experimental Procedures

All subjects were tested individually on all instruments by a speech pathologist who was trained to administer the measures. Each subject was tested in an individual therapy room. First, all subjects or their families completed a questionnaire regarding the patient's prior drawing and drafting experience. Second, the Western Aphasia Battery (Kertesz, 1982) was administered to the aphasic groups but not to the control group. Third, the Rey-

Osterrieth Complex Figure Test and the CDT were administered to the three aphasic groups and the control group.

Each subject was tested in two sessions, and each session lasted approximately one hour. During the first session the WAB was administered, and during the second session the Rey-Osterrieth and the CDT were administered. Two decoders were selected to assist the examiner in the administration of the CDT. They served as judges of the subject's ability to produce drawings that relayed communicative information. The two decoders were relatives, friends, therapists, or acquaintances of the subject with whom they participated. This simulated the situation within which the subject is most likely to communicate. Each decoder was used with one subject only so as to insure that the decoders were naive observers of the CDT stimuli. The examiner and subject sat side-by-side at a table, and the decoders sat across the table from them so that the decoders could not see the photographic stimuli.

Several types of instructions were given to each aphasic subject prior to administration of the experimental procedures. Both verbal and nonverbal instructions were given simultaneously to each subject. Initially, the examiner showed the subject a demonstration photograph. The examiner explained to the subject that he was expected to communicate the idea in the pictures by drawing a picture and then showing it to the decoders. Simultaneously, the examiner pantomimed the instructions by first pointing to the photograph, and then to a blank sheet of paper. Finally, the examiner held up the paper for the decoders to see. In addition, the subject was informed that he was going to (a) hold the pen in his nondominant (left) hand, (b) draw a picture that would show the decoders what meaning the particular stimulus item conveys (e.g., "draw the idea," "they need to know the idea," "keep it simple," "don't worry about whether it looks like the photograph," "try not to copy the photograph"), and (c) communicate the idea only through drawing, not through talking or gesturing. The examiner explained that using the nondominant hand would not be easy and that it would be hard to make that hand do what you want it to do (e.g., "the lines would be wiggly"). The examiner illustrated the task by drawing a simple picture of a demonstration photograph (young girl on a swing), and then reiterated that the drawing was to be simple and not a copy of the photograph. The examiner then showed the drawing to the decoders, who recorded independently what the examiner intended to communicate.

To determine if a subject understood the task, the examiner used up to six photographs (hands, canoe, semitruck, broom, girl sleeping, boy catching baseball). If the subject did not show comprehension of the task after six trial items, the subject was eliminated from the study. If, however, the subject displayed behavior that indicated he understood the task, the examiner terminated the selection segment of the study and administered the twelve items constituting the CDT.

The photographs were presented one at a time, and were presented in an alternating order (first object then action). The order was the same for all subjects. They drew representations of the photographs with a fine-point, felt tip pen. Since most of the subjects had a hemiparesis, a clipboard was used to stabilize the paper on which the subjects produced their drawings.

The two decoders looked at each of the subject's drawings and attempted to interpret the communicative intent of the subject's pictures. The decoders used a data form (Appendix A) to record their interpretation of the subject's drawings. They independently wrote a word or phrase to describe their interpretation of the twelve concepts that the subjects intended to communicate, and they used the Observer Confidence scale (Appendix A) to indicate their own levels of confidence in the interpretation of the subject's drawings. When the examiner and the decoders were shown a drawing, they responded by saying "good," "try the next one," or "great, do another one." After completion of the CDT, the examiner collected the decoders' forms and thanked everyone for participating in the study.

The CDT produces two scores, the "Visual Recognition Score" and the "Observer Confidence Score." The Visual Recognition Score reflects the accuracy with which the 12 drawings of the aphasic subjects communicate their intentions. Using a four point rating scale (0 = inaccurate, unrelated; 1 = inaccurate, related; 2 = accurate, incomplete; 3 = accurate, complete), the examiner evaluated the responses of each decoder. The points on the Visual Recognition scale were adopted from Lyon's scoring system (1985). The mean of the 12 responses of each decoder was calculated separately, resulting in two mean accuracy scores for each subject. VR1 denotes the mean score derived from the responses of one decoder, and VR2 the other decoder (Appendix B). The Observer Confidence Score reflects the degree to which the decoders were confident of their interpretations of the subjects' drawings. The Observer Confidence procedure consists of a four-point rating scale (1 = very unsure; 2 = unsure; 3 = confident; 4 = very confident). The mean of the 12 responses of each decoder was calculated separately, resulting in two mean confidence scores for each subject. 0C1 denotes the mean score derived from the responses of one decoder, and OC2 the other decoder (Appendix B). No data analyses were conducted on the OC scores.

CHAPTER III
RESULTS

The purpose of this study was to investigate the ability of aphasic patients to produce communicative drawings. This chapter summarizes the statistical analyses and presents these results as they relate to the three research questions posed in Chapter I. Data analyses were conducted through the University of Florida Center for Instructional and Research Computing Activities using the Statistical Analysis System (SAS) program.

The following is a summary of the hypotheses: (a) aphasic subjects will evidence a depressed ability to produce communicative drawings as compared to the control group; (b) aphasic groups (Broca's, Wernicke's, and Global) will perform differently from each other in their ability to produce communicative drawings; and (c) some combination of the nine independent variables will predict the Visual Recognition scores of the aphasic patients on the Communicative Drawing Task (CDT).

Statistical Treatment

An analysis of covariance, a form of a General Linear Models Procedure, was used to test whether or not to control for any of the independent variables prior to statistical manipulation of the data regarding the first two hypotheses. This procedure indicated the need to adjust only for the variable of Age to enable the four population groups to be comparable. Failure to statistically adjust for the Age variable would have produced erroneous results. Specifically, with Age as the independent variable, the significance level of F was .004 for First

Decoders and .005 for Second Decoders. Since both values are equal to or less than .005, the decision was made to control for Age.

A multivariate analysis of variance was used to test the first two hypotheses. Least Squares Means analyses were used to test the first two hypotheses because it adjusts for Age. Through the use of the Least Squares Means test it is possible to statistically rule out the affect of age. Such an adjustment in this instance provides more accurate results than would be possible with other types of analyses, such as the Sheffe's test.

The last hypothesis was tested with the Multiple Regression Model to determine which variables were predictive of the subjects' Communicative Drawing Task (CDT), Visual Recognition scores.

All hypotheses deal with the accuracy of the subjects' drawings (Visual Recognition scores); not the Observer Confidence scores. The significance level for the first two hypotheses was set at the .05 level, whereas the significance level for the third hypothesis was set at the .005 level because of the large number of computations. The raw data are listed in Appendix B and sample drawings are found in Appendix C.

The interrater reliability was established for each pair of decoders for each subject. A high interrater reliability (.947) was found between the sets of decoders. Therefore, each pair of decoder scores was averaged, yielding one mean Visual Recognition score for each subject.

The succeeding sections of this chapter restate the experimental hypotheses in the study along with the statistical findings associated with each hypothesis. This information is presented under three major headings: (a) comparison of the control and the aphasic groups; (b) comparison of the three aphasic groups; and (c) prediction of the CDT Visual Recognition scores from some combination of nine independent variables.

Comparison of the Control and the Aphasic Groups

Hypothesis One: The aphasic subjects will evidence a depressed ability to produce recognizable drawings as compared to the control group.

Data used for these analyses were the decoders' Visual Recognition scores. The Least Squares Means Procedure was computed using the combined adjusted means and standard errors of the decoders' scores.

Action and Object Items Combined

Table 3.1 shows the adjusted means and standard error values for Action and Object items combined. The scores in order of performance are 4.99 for the controls, 4.08 for the Broca's aphasics, 3.85 for the Wernicke's aphasics, and 2.54 for the Global aphasics. The larger the value the better the performance. That is, a higher score indicates increased accuracy on the part of the decoder when interpreting the communicative intent of the subject.

Table 3.1
ADJUSTED MEANS AND STANDARD ERRORS OF CDT SCORES:
ACTION AND OBJECT ITEMS COMBINED

GROUP	LEAST SQUARES MEANS	STANDARD ERROR OF LEAST SQUARES MEANS
Broca's	4.08	.309
Global	2.54	.336
Wernicke's	3.85	.304
Control	4.99	.332

The Least Squares Means tests of differences was used on these data to compare the control group with the aphasic groups. Table 3.2 presents the results. When the Action and Object items are combined, significant differences existed between the performance of the control group and the performance of each of the aphasic groups beyond the .05 level. The control group performed significantly better than each of the aphasic groups.

Table 3.2
LEAST SQUARE MEANS TEST OF DIFFERENCE BETWEEN CONTROL AND APHASIC GROUPS: ACTION AND OBJECT ITEMS COMBINED

	BROCA'S	GLOBAL	WERNICKE'S
Control	.379 *	.0149 *	.0001 *

* p less than or equal to .05 level of significance

Action Items. Table 3.3 shows the adjusted means and standard error values for Action items alone. The scores in order of performance are 4.46 for the Controls, 3.33 for the Broca's aphasics, 2.90 for the Wernicke's aphasics, and 1.89 for the Global aphasics.

Table 3.3
ADJUSTED MEANS AND STANDARD ERRORS OF CDT SCORES: ACTION ITEMS

GROUP	LEAST SQUARES MEANS	STANDARD ERROR OF LEAST SQUARES MEANS
Broca's	3.33	.300
Global	1.89	.327
Wernicke's	2.90	.296
Control	4.46	.323

The Least Squares Means tests of differences were used to compare the control group with each of the aphasic groups. Table 3.4 presents the results. Significant differences exist between the control group and each of the aphasic groups beyond the .05 level. The control group performed significantly better than each of the aphasic groups.

Table 3.4
LEAST SQUARE MEANS TEST OF DIFFERENCE BETWEEN CONTROL AND APHASIC GROUPS: ACTION ITEMS

	BROCA'S	GLOBAL	WERNICKE'S
Control	.0091 *	.0001 *	.0009 *

* p less than or equal to .05 level of significance

Object items. Table 3.5 shows the adjusted means and standard error values for the Object items alone. The scores in order of performance are 5.67 for the Controls, 5.09 for the Wernicke's aphasics, 5.01 for the Broca's aphasics, and 3.11 for the Global aphasics.

Table 3.5
ADJUSTED MEANS AND STANDARD ERRORS OF CDT SCORES: OBJECT ITEMS

GROUP	LEAST SQUARES MEANS	STANDARD ERROR OF LEAST SQUARES MEANS
Broca's	5.01	.374
Global	3.11	.407
Wernicke's	5.09	.368
Control	5.67	.402

The Least Squares Means tests of differences between the control group and each of the three experimental groups were calculated. Table 3.6 reports the results. A significant difference exists between the control group and the Global aphasics on the Object items. There are no significant differences between the control group and the Broca's aphasics or the Wernicke's aphasics.

Table 3.6
LEAST SQUARE MEANS TEST OF DIFFERENCE BETWEEN CONTROL AND APHASIC GROUPS: OBJECT ITEMS

	BROCA'S	GLOBAL	WERNICKE'S
Control	.2124	.0002 *	.2944

* p less than or equal to .05 level of significance

Comparison of the Three Aphasic Groups

Hypothesis Two: The three groups of aphasic patients (Broca's, Wernicke's, and Global) will perform differently from each other in their ability to produce recognizable drawings. It was expected that Broca's patients would be more successful than Wernicke's patients when drawing to communicate the object stimuli, and, conversely, it was expected that Wernicke's patients would be more successful than the Broca's patients when drawing to communicate the action stimuli .

Data used for these analyses were the decoders' Visual Recognition scores. The Least Squares Means procedure was computed using the combined adjusted means and standard errors of the decoders to compare the aphasic groups.

Action and Object Items Combined

Table 3.7 presents the findings. There are significant differences among the aphasic groups when their drawing performance on Action and Object items are combined. The Broca's and Wernicke's patients performed significantly better than the Global patients. There are no significant differences between the Broca's and Wernicke's patients.

Table 3.7
LEAST SQUARE MEANS TEST OF DIFFERENCE AMONG APHASIC GROUPS: ACTION AND OBJECT ITEMS COMBINED

	BROCA'S	GLOBAL
Broca's		
Global	.0023 *	
Wernicke's	.5992	.0046

* p less than or equal to .05 level of significance

Action Items. Table 3.8 shows there are significant differences between the groups of aphasics when their drawing performance on Action items alone are compared. The Broca's and Wernicke's patients performed significantly better than the Global patients. There is no significant difference between the Broca's and the Wernicke's groups.

Table 3.8
LEAST SQUARE MEANS TEST OF DIFFERENCE AMONG APHASIC GROUPS: ACTION ITEMS

	BROCA'S	GLOBAL
Broca's		
Global	.0035 *	
Wernicke's	.3268	.0221 *

* p less than or equal to .05 level of significance

Object Items. Table 3.9 shows that significant differences were found between the groups of aphasics when their drawing performance on Object items alone were compared. The Broca's and Wernicke's patients performed significantly better than the Global patients. There was no significant difference between the Broca's and Wernicke's patients.

Table 3.9
LEAST SQUARE MEANS TEST OF DIFFERENCE AMONG APHASIC GROUPS: OBJECT ITEMS

	BROCA'S	GLOBAL
Broca's		
Global	.0021*	
Wernicke's	.8918	.0006*

* p less than or equal to .05 level of significance

Prediction of the CDT Visual Recognition Scores

Hypothesis Three: Some combination of the nine independent variables including age, ability to repeat phrases, naming ability, speech information content, Aphasia Quotient (A.Q.), score on the WAB drawing subtest, months post onset of CVA, Rey-Osterrieth score, and number of demonstration items needed to train for CDT, will predict the Visual Recognition scores of the aphasic patients on the Communicative Drawing Task (CDT).

A Multivariate Analysis of Variance was used to assess the predictability of the Visual Recognition scores of the CDT from each of the nine independent variables singularly. The level of significance was set at the .005 level to compensate for the number of probability values that were calculated. Table 3.10 shows that the Rey-Osterrieth is the only single variable predictive of the Visual Recognition scores at an acceptable level of significance for the sets of Object and Action combined and the Object items alone. The R^2's for the Object and Action combined (.739) and Object (.681) items indicate that the amount of variance accounted for by the association of the Rey-Osterrieth and the Visual Recognition scores is approximately 74 percent for the Object and Action items combined, and 68 percent for the Object items alone.

Table 3.10
PREDICTING THE VISUAL RECOGNITION CDT SCORES
FROM THE NINE INDEPENDENT VARIABLES:
ACCOUNTED FOR VARIANCE AND STATISTICAL SIGNIFICANCE

INDEPENDENT VARIABLES	DEPENDENT VARIABLES					
	OBJECT/ACTION		OBJECT		ACTION	
	R^2	p	R^2	p	R^2	p
Age	.344	.466	.201	.928	.427	.067
Repetition	.261	.104	.212	.282	.036	.028
Naming	.223	.913	.122	.799	.314	.497
Information	.343	.546	.226	.253	.409	.355
A.Q.	.344	.377	.269	.332	.408	.046
WAB Drawing	.653	.263	.529	.562	.583	.392
Post Onset	.089	.993	.068	.895	.109	.716
Rey-Osterrieth	.739	.003*	.681	.002*	.612	.059
Demo No.	.020	.560	.042	.571	.014	.622

* At or beyond the .005 level of significance

A Multiple Regression Analysis also was computed to determine the maximum amount of variance that combinations of the independent variables contribute to the predictability of the CDT Visual Recognition scores. The independent variables were evaluated in all possible combinations using models with one through five elements. The model using one element, the Rey-Osterrieth, accounts for approximately 74 percent of the variability. When that model was expanded to include the Rey-Osterrieth and the other variables within a five-element model, an additional four percent at best is accounted for. This small increase does not warrant the use of a more complex version of the multiple regression equation.

Summary

The control subjects performed significantly better than did the aphasic subjects on two types of stimuli--combination of actions and objects, and actions. The control group did not perform significantly better than either the Broca's or Wernicke's groups on the object items, but they did perform better than the Global group. In addition, the Broca's aphasics and the Wernicke's aphasics consistently performed better than the Global aphasics. No significant differences were found between the Broca's and the Wernicke's subjects on any of the sets of scores. All groups scored higher on object than on action stimuli. The Rey-Osterrieth is the only single variable, of the nine independent variables, that has practical utility in predicting CDT Visual Recognition scores.

CHAPTER IV
CONCLUSIONS AND DISCUSSION

The purposes of this investigation were to examine the ability of aphasic adults to produce recognizable communicative visual images prior to drawing training, to determine whether patients with different types of aphasia differ significantly in their ability to produce drawings that are interpretable by uninformed decoders, and to predict drawing effectiveness from standardized instruments.

In this chapter the findings of the study are discussed, interpreted, and related to other studies. Also, conclusions are drawn and clinical suggestions are posited based on information associated with the study.

Conclusions and Discussions of Hypotheses

Comparison of Control and Aphasic Groups

Overall, the performance of the Control group is superior to the aphasic groups. More specifically, when action and object item communication scores are combined, the Control group performs significantly better than each of the aphasic groups. Similarly, when action item communication scores are considered alone, the Control group performs significantly better than each of the aphasic groups. When only object item communication scores are considered, a difference is found between the Control and the Global aphasic groups; however, no differences exist between the Control group and either the Broca's or the Wernicke's groups.

These findings partially support the first hypothesis of this study. To the extent the first hypothesis is supported, it lends construct validity to the Communicative Drawing Task(CDT) instrument since theoretically it should be expected that language-normal subjects would exhibit superior performance on a communication task when compared with aphasic subjects. Gainotti et al. (1983) also found language-normal subjects superior to the aphasic subjects in their study even though these researchers studied the aphasics' ability to draw from memory.

Comparison Across Three Aphasic Groups

The second hypothesis predicted significant differences among Broca's, Wernicke's, and Global aphasics. At the time this study was initiated, there were no empirical data in the literature that would predict directly the relationship among the three groups of aphasics on a communicative drawing tasks such as the CDT. The hypothesis was extrapolated from the well-documented differences in their performances on verbal tasks. Since then, Trupe (1986) reported no difference in the performance among Broca's, Wernicke's, or Global patients in a task similar to the CDT, but she found a difference between the Broca's and Wernicke's groups of aphasics in their generalization of these skills. Unfortunately, no statistical analyses are reported to indicate if these differences are statistically significant; therefore, the current study is the first one that uses inferential statistical analysis to test this hypothesis.

This study showed (a) the Global aphasic group was less proficient in producing interpretable drawings than either the Broca's or Wernicke's groups, and (b) no empirical differences existed between the Broca's and Wernicke's groups in their ability to produce communicative drawings. These findings partially support the second hypothesis in that differential performance occurred between the Global aphasics as compared to the Broca's and Wernicke's aphasics. The partial acceptance of the second hypothesis lends further construct validity to the CDT instrument since the related literature and clinical experience suggest that individuals with Global aphasia should exhibit more compromised communication skills, both verbally and nonverbally, than those with Broca's or Wernicke's aphasia. That no differences were found between the latter two groups fills a gap in our knowledge about the ability of aphasic adults to produce communicative drawings.

Predictive Relationships

From the results of this study, a Rey-Osterrieth score, which reflects its non-memory aspect, is a strong, single predictor of the CDT Visual Recognition scores for the combination of object and action items and also for object items separately; but not for action items alone. These findings indicate that hypothesis three is partially supported.

During administration of both the CDT and the non-memory portion of the Rey-Osterrieth, subjects were allowed to refer back to the stimulus figure as they attempted to graphically produce it. Therefore, it is not surprising that the Rey-Osterrieth would be predictive of the patient's ability to select salient features from the stimulus photographs and produce recognizable renderings.

These findings are important because the CDT takes approximately 50 minutes to administer, whereas the Rey-Osterrieth takes approximately 7 minutes. Since the Rey-Osterrieth is highly correlated with the CDT, it might be efficient to use it when trying to identify the subset of patients who should be given the CDT. This could save valuable testing time.

These findings are even more important because they imply that the more traditional aphasia instruments, such as the WAB, do not measure aphasic adults' spared cognitive, ideational processes that may be relatively intact even in the presence of a severe language deficit. The WAB appears to measure the generic, symbolic ability that is prerequisite to, and underlies, both verbal and nonverbal linguistic communicative behaviors (Duffy & Duffy, 1981). However, the nonlinguistic aspects of communication probably are not being measured adequately by such instruments. None of the WAB scores are predictive of the CDT Visual

Recognition scores. In fact, the low scores on the WAB may mislead clinicians into denying patients the opportunity to try communicative drawing therapy. Clinicians often have used such instruments as predictors of positive prognosis in therapy and as an index as to the type of therapy to use. The Global group, as expected, scored the lowest on the WAB; and even within this group the WAB is a poor predictor of how well an aphasic can communicate through drawing as measured by the CDT. This can be seen in Table 4.1. where the Global group is divided into the top and lower halves of scorers on the CDT. All of these patients had no functional means of communication and were performing very poorly on the WAB. The highest WAB score of 39.8 is indicative of a severe communication deficit – individuals who are language-normal "regularly achieve AQs of 100" (Kertesz, 1982). Nevertheless, Table 4.1 shows 50 per cent of the Global subjects were able, without training, to produce drawings that were unexpectedly communicative. The most extreme example is subject 34. He had an A.Q. of only 2.1 out of a possible 100, yet scored 2.16 out of a possible 3.0 on the CDT. As will be explained later, observations by the investigator indicate that some patients with extremely low WAB scores can profit from drawing therapy. It would seem that development of instruments to more accurately evaluate some of the underlying cognitive, nonlinguistic abilities of the aphasic adult, particularly the Globally aphasic adult, would be an important clinical achievement. This study was an attempt to further such clinical developments.

No one of the other four independent variables (age, months post onset, number of demonstration items needed to train for the CDT, or time to complete the CDT) are practical predictors of the CDT Visual Recognition scores.

The use of multiple predictors of CDT Visual Recognition scores increases the accounted for variance minimually. Using combinations of the nine independent variables, five at a time, the multivariant analyses only increased the accounted for variance approximately four per cent above that of the single variable, the Rey-Osterrieth. Therefore, the benefit in prediction does not justify a multiple variable predictive approach.

Table 4.1
GLOBAL APHASICS: APHASIA QUOTIENT OF THE WESTERN APHASIA BATTERY (AQ WAB) AS PREDICTOR OF COMMUNICATIVE DRAWING TASK (CDT) PERFORMANCE

ID NO.	WAB AQ	CDT VR1	CDT VR2	COMMUNICATION SYSTEM AT TIME OF TESTING
Recommended for Drawing Therapy				
33	39.8	2.41	2.41	None
34	2.1	2.16	2.16	Three Signs
30	10.3	1.41	1.50	None
42	2.6	1.30	1.50	None
37	7.6	1.25	1.91	None
41	8.5	1.25	1.25	None
29	10.4	1.08	1.16	None
Not Recommended for Drawing Therapy				
31	13.2	0.75	0.75	None
36	8.2	0.58	0.75	None
39	6.5	0.58	0.50	None
35	3.0	0.41	0.41	None
38	4.1	0.41	0.33	None
32	0.0	0.25	0.41	None
40	8.8	0.25	0.25	None

Limitations

This study should be viewed as contributing to the beginning of a line of inquiry. Only a limited number of studies have examined this area. Furthermore, the majority of the existing studies remain unpublished and are therefore not readily available to speech/language clinical practitioners.

There may be important variables that should have been controlled that were not, or that could not be controlled in the present study. On the one hand, it is not known to what extent the criteria for acceptance as a patient at Tampa General Rehabilitation Center may have biased the sample. For example, it is not appropriate to generalize the findings of this study to aphasic patients whose families would not provide assurance of adequate living facilities when discharged from the Center. On the other hand, from the patients admitted with Broca's, Wernicke's or Global aphasia, only two were not included in the study (one could not understand the task while the other could understand but refused to finish the entire CDT). It is the clinical judgment of the investigator that on balance each group of subjects appeared to be representative of the parent populations under consideration. Consequently, the outcomes of the study should have some generalizability to other samples of these types of aphasics.

Observations Associated with the Study

The investigator reviewed all of the drawings produced by the aphasic and the control subjects to identify features which seem to enhance the communicative properties of drawing. However, it must be emphasized that these features should be considered tentative at best until more studies can verify them. Of the possible dimensions, the following appear to be of some importance: the amount of detail, the size of productions, the ability to draw people using objects in a clear integrated fashion, the placement of drawing on the page, the frequency with which stick figures are used to depict humans, the absence of extraneous or obscuring lines, the use of words in pictures to provide cues, and the presence of symptoms of visual neglect.

Several studies (Hatfield and Zangwell, 1974; Lyon and Sims, 1984, 1986, 1988; Morgan and Helm-Estabrooks, 1987; Trupe, 1986; and Yedor and Kearns, 1987) concluded that aphasic patients could communicate, or could be trained to communicate, using drawing. Data and observations from this study reaffirmed the potential of the drawing modality as a viable medium for communication.

Unexpectedly, Global aphasic patients in this study appear to be a promising group to train for the use of communicative drawing. There are Global aphasic patients who, while unable to learn more traditional means of communication, appear to be able to achieve some degree of communicative success through drawing. To illustrate, one of the Global aphasic patients in the study had been in speech/language therapy but had been unable to learn to use any communicative method prior to taking the CDT. He achieved some success during the CDT and realized his increased potential to communicate. Once he started drawing, he began to spontaneously write parts of words on the page with the corresponding pictures. Prior to the CDT he had not produced writing. These experiences resulted in a general increased desire to communicate, and a specific desire to train in the use of drawing as a mode of communication. Although training aphasics to communicate through drawing was beyond the scope of this study, on the basis of clinical hunches the investigator recommended to the clinicians who were serving seven members of the Global group that they be given drawing therapy. Table 4.1 shows that all of those recommended for drawing therapy in fact had higher Visual Recognition scores than those not recommended. Three of the seven subsequently became functional communicators using drawing; unfortunately, no information is available about the remaining four subjects since they were discharged from Tampa General Rehabilitation Center and left the immediate geographic area before receiving drawing therapy. The results of the only other study that included Global aphasics as subjects, Trupe (1986), support the observation that Global patients are promising candidates for training to use communicative drawing.

The Global aphasics appeared to approach the CDT task with more anxiety than the Control, the Broca's, and the Wernicke's groups. However, a small percentage of the latter two groups seemed to be as anxious as the Global subjects. An even smaller percent of them were comfortable; but the majority of them appeared to exhibit a neutral attitude regarding the task. The Global patients' unease may be due to their history of failure in communicating when using other modalities. Those patients who were more successful on the CDT than they had anticipated dramatically increased their efforts to communicate.

Success with communication through drawing seems to enhance the patient's entire rehabilitation process. For example, when other rehabilitation professionals were shown patients' drawings from the CDT, particularly patients who were known to be nonfluent and severely communicatively impaired, the rehabilitation professionals modified their opinion of the patients, and raised their expectations of the patients potential. In addition, the expectations of the decoders was raised. At the beginning of the CDT procedures, expectations were rather low, but at the end of the session the expectations were raised dramatically, and the subjects also were amazed that they were able to do the task so well. In general, there appears to be an attitude in our society that being nonverbal is equal to being unintelligent, and vice versa. Negative expectations of others interferes with the rehabilitation process. People tend to avoid interacting with such patients, and practice in communication is diminished. Also, professionals and others talk about patients instead of talking to them. This reduces the participation of the patients in their own rehabilitation process. Further, families of the patients tend to adopt this attitude and isolate patients from family interactions.

Confidence of decoders appears to be unrelated to a their ability to interpret drawings. During the study decoders were observed who were decoding very accurately but who expressed poor confidence in their decoding ability. The opposite was also noted. While it would seem that high Observer Confidence scores would indicate high comfort level of the decoders with the task, a high correlation between Visual Recognition scores and Observer Confidence scores should not be expected because the personality of the decoder comes into play.

Even though some of the decoders were unsure of their interpretations of the drawings, all of them appeared to be highly motivated and showed little or no fatigue during administration of the CDT. This was probably a result of one aspect of the study design (i.e., the decoders were either related to or already knew the subject, and cared whether or not the subject was successful on the task). The decoders involved with the more severely impaired aphasic patients were particularly motivated. They verbally indicated their hope that the CDT session might indicate potential for the patient to develop a functional communicative system since all previous attempts to train alternative communicative modalities had failed. The relationship between the patients and the decoders might have contributed to the motivation of the patients.

The ability of aphasic patients to communicate to their relatives and acquaintances through drawings probably can be generalized beyond this study. In no case were the decoders aware of what the aphasics intended to communicate; yet, communication did occur.

Recommendations of Future Studies

Because there is limited literature regarding drawing as a functional means of communication and because drawing therapy seems promising, there is a great need for further investigation of the following aspects:

1. The results from one study should not be accepted without replications. Even though the size of the samples of Broca's, Wernicke's, and Global subjects were larger than any studies reviewed, replication with larger samples would be desirable to avoid the unlikely event that the results occurred by chance.
2. Even though there was consistency in the way the CDT and the Rey-Osterrieth were administered and scored, because one person conducted them, it is not known if others would get the same results. Therefore, it is important to ascertain

whether or not typical therapists can obtain essentially the same results. If other clinicians can not obtain similar results, then this approach to communication would not be of value to the field of speech-language pathology.

3. The development, standardization, and research study of the properties of CDT-type instruments are critically needed (e.g., reliability, validity, and equivalency across instruments). At least some of this work should be done before other studies are initiated. To do otherwise would make it difficult to integrate the results of different studies. If only experimental instruments are used and if the variety of different instruments across studies measure different aspects of drawing to communicate, faulty conclusions can be drawn about the status of knowledge on this topic. Furthermore, experience with research indicates that new, clinically relevant and well constructed instruments to measure phenomenon of interest stimulates research.
4. Messages possibly can be classified into different content classes (e.g., what/if questions, wh-questions, describing emotions, sequencing events, as well as object and action representations). If they can be classified, it would be helpful in designing measuring instruments and therapy protocols.
5. Observations during the study suggest it is more difficult for subjects to accurately represent the action of a person than to draw an object. Therefore, if a comparison is to be drawn between the performance of subjects on object and action items in future studies, it is recommended that the difficulty level between them be equated. If it is found that object items are easier to represent than action ones, then a study could be designed to determine whether or not patients in therapy should begin training to draw objects before actions are included.
6. It is possible that training to communicate through drawing facilitates other means of expression (e.g., intersystemic stimulation of writing or speech).

7. It would be productive to determine the most efficient and effective methods of training aphasics to communicate through drawing. It is possible that there are different methods for different types of aphasics.
8. It would be helpful to determine the characteristics of efficient ways of drawing to communicate. Cartoonists probably can identify conventional ways of drawing which are widely understood by most people and are efficient in the amount of drawing effort. If a "short-hand" system can be developed, then ideas can be communicated more rapidly and in turn interactions would be less labored and frustrating.
9. It may be that there is a common set of frequently used messages which every aphasic should learn to communicate through drawing. If there is such a set, then the content could be identified and organized into a core vocabulary to be taught.
10. Future treatment studies could be designed to find which aphasic groups would profit from communicative drawing therapy; also, studies could be designed to determine within groups which patients show the most potential. In all likelihood, aphasic patients within these groups would not profit to the same extent. For instance, is there a subset of patients not now using drawing who score low on the WAB A.Q. and are unsuccessful in other therapies, but score relatively high on a CDT-type tests and can be successful when using drawing as a communicative modality? In other words, can indicators be identified that would predict the degree of success for individual patients when using drawing as a way of communicating?
11. Group dynamics need to be identified and evaluated as to their effect on communication through drawing so that aphasics can better communicate among themselves and with significant others. For example, will the volume and

complexity of communication differ depending on the membership of the group (e.g., type of aphasia and with whom the patients communicate)?

12. Personal characteristics and situational conditions should be identified that would enhance interpretation of drawings done by aphasics. These studies could have implications for the training of Speech Pathologists, allied rehabilitation professionals, and others relating to aphasics. For example, the level of education of aphasics and the education of the viewers of their drawings could possibly influence the outcomes of communication.
13. Significant others probably can be trained to facilitate the communication through drawing efforts of the aphasic adult, and to continue the training process outside the clinical setting. Defining training sequences for significant others would increase the efficiency of the aphasics' communicative drawing therapy. In addition, such training may make significant others generally better communication partners for aphasic adults.

Summary

Researchers need to further explore drawing as a communicative modality for language-impaired individuals. The results of this study and the existing literature clearly indicate the clinical promise of communicative drawing. Indeed, even some of the most severely language-disordered individuals, Global aphasics, demonstrate the ability to produce communicative drawings.

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Personal Communication:

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2. Silveri, K. (March, 1985). Telephone call to Rome, Italy.
3. Helm-Estabrooks, N. (March, 1985). Conference at South Miami Hospital.
4. Lyon, J. (April, 1985). Telephone call to V.A. Medical Center in Reno, Nevada.
5. Lyon, J. (July, 1988). Telephone call to V.A. Medical Center in Reno, Nevada.

APPENDIX A
FORMS

CDT DECODER DATA

Name of Observer:________________________________
Relation to Person Observed:______________________
Date of Observation:______________________________
Age of Person Observed:___________________________
Time for completion of CDT:_______________________

Label (name) of thing or action subject has drawn

Observer Confidence re: Communicative Effectiveness Scale

3-accurate, complete

2-accurate, incomplete

1-inaccurate, related

0-inaccurate, unrelated

		1 Very Unsure	2 Unsure	3 Confident	4 Very Confident
____1					
____2					
____3					
____4					
____5					
____6					
____7					
____8					
____9					
____10					
____11					
____12					

Training Demo items:
(not judged by observer)

1.________________________ 4.________________________

2.________________________ 5.________________________

3.________________________ 6.________________________

Total of Visual Recognition Scores______; / 12 = _______ Visual Recognition Rating

Total of Observer Confidence Scores ______; / 12 = ______ Observer Confidence Rating

Visual Recognition Rating - range ______ to ______

Observer Confidence Rating - range ______ to ______

DATE________________

CDT SUBJECT DATE

APHASIC SUBJECT________________

CONTROL SUBJECT________________

AGE________________

SEX________________

TYPE OF APHASIA________________

FLUENCY OF SPEECH________________

AUDITORY COMPREHENSION ABILITIES________________

ABILITY TO REPEAT________________

NAMING ABILITIES________________

INFORMATION CONTENT OF SPEECH________________

SEVERITY OF APHASIA________________

MONTHS POST ONSET CVA________________

FORMER EXPERIENCE WITH DRAWING________________

TRAINED NUMBER DEMO ITEMS________________

REY-OSTERRIETH COMPLEX FIGURE TEST SCORE________________

NO INDICATION CLINICALLY DEPRESSED________________

DOMINANT HAND PRIOR CVA________________

FUNCTIONAL COMMUNICATION THROUGH WHICH MODALITY________________

____

WAB DRAWING SUBTEST________________

VISUAL RECOGNITION RATINGS__________ ________________

OBSERVER CONFIDENCE RATINGS__________ ________________

TIME TO COMPLETE CDT________________

SUBJECT____________________

CDT SUBJECT'S PRIOR DRAWING EXPERIENCE QUESTIONNAIRE

1. Has patient ever held job where drawing or drafting was one of his/her responsibilities?

_________. If yes, when and for how long?______________________________

2. Has patient ever enrolled in drawing or drafting class? _________. If yes, when and for how long?______________________________

3. Prior to CVA did patient draw or draft as a hobby? _________. If yes, when and for how long?______________________________

INFORMED CONSENT I

The purpose of this study is to investigate the ability of aphasic adults to draw pictures to communicate ideas. The aphasic adults participating in this study will be asked to complete: (1) The Western Aphasia Battery (this is a standardized test to determine the type of aphasia a person may have); (2) The Rey-Osterrieth Complex Figure Test (this is a standardized test to evaluate a person's ability to copy a drawing); (3) The Communicative Drawing Task (this is an experimental procedure developed to determine if aphasic patients can draw pictures to communicate). The subjects will be shown 12 large color photographs, one at a time, and will be asked to draw the main idea expressed in the photograph so that an uniformed person would understand this idea.

No risks or discomfort to the subjects are anticipated. A benefit may occur to the subject if we find they have communicative drawing ability. If this should happen, this ability could be trained during the patients regular; speech therapy sessions and might result in improved communicative ability for the patient.

The examiner/investigator will answer any questions concerning these procedures. The subject is free to withdraw his/her consent and to discontinue participation in the project or activity at any time without prejudice. Monetary compensation will not be awarded.

I have read and I understand the procedure described above. I agree to participate this research project and I have received a copy of this description. I agree to allow the Principal Investigator to publish the results of this procedure as part of the total research project, it being understood that the names of individual participants will be kept confidential and not specified.

Subject's Signature Date

Witness' Signature Date

Principal Investigator Date
Sandra L. Evans
University of Florida Doctoral Candidate
c/o Speech and Audiology Department
Tampa General Hospital
Tampa, Florida 33606
(813) 251-7737

INFORMED CONSENT II

The purpose of this study is to investigate the ability of aphasic adults to draw pictures to communicate ideas. The aphasic adults participating in this study will be asked to complete: (1) The Western Aphasia Battery (this is a standardized test to determine the type of aphasia a person may have); (2) The Rey-Osterrieth Complex Figure Test (this is a standardized test to evaluate a person's ability to copy a drawing); (3) The Communicative Drawing Task (this is an experimental procedure developed to determine if aphasic patients can draw pictures to communicate). The subjects will be shown 12 large color photographs, one at a time, and will be asked to draw the main idea expressed in the photograph so that an uniformed person would understand this idea.

No risks or discomfort to the subjects are anticipated. A benefit may occur to the subject if we find they have communicative drawing ability. If this should happen, this ability could be trained during the patients regular; speech therapy sessions and might result in improved communicative ability for the patient.

The examiner/investigator will answer any questions concerning these procedures. The subject is free to withdraw his/her consent and to discontinue participation in the project or activity at any time without prejudice. Monetary compensation will not be awarded.

I have read and I understand the procedure described above. I agree to participate this research project and I have received a copy of this description. I agree to allow the Principal Investigator to publish the results of this procedure as part of the total research project, it being understood that the names of individual participants will be kept confidential and not specified.

Signature & Relationship if Other than Subject — Date

Witness' Signature — Date

Principal Investigator — Date
Sandra L. Evans
University of Florida Doctoral Candidate
c/o Speech and Audiology Department
Tampa General Hospital
Tampa, Florida 33606
(813) 251-7737

APPENDIX B
RAW DATA

Broca's Aphasics' Raw Data-1

Subject ID No.	Time Post Onset	Western Aphasia Battery Fluency	Aud.Comp.	Repeat.	Naming	Info. Cont.	A.Q.	Drw. Sub.
1	1 month	4	9.0	5.0	4.0	7	58.0	28.0
2	3 months	2	9.6	4.3	6.6	7	59.0	30.0
3	3 months	0	5.15	0.0	0.0	0	10.3	12.0
4	11 months	4	6.8	5.2	3.75	8	55.5	25.0
5	7 years	2	9.6	5.3	7.5	4	56.8	21.0
6	4 years	3	10.0	7.0	6.2	4	60.4	17.5
7	2 months	4	8.5	4.2	7.8	8	65.0	22.0
8	3 months	4	8.65	4.6	6.4	8	63.3	21.5
9	4 years	4	7.7	3.2	7.4	8	60.6	26.0
10	7 months	0	7.5	0.0	0.0	0	15.0	20.5
11	11 months	1	6.95	3.3	2.8	3	34.1	23.5
12	22 months	0	4.2	0.8	0.1	3	16.2	19.0
13	15 months	4	6.1	5.2	5.9	6	54.4	20.0
14	1 month	0	5.55	0.0	0.0	0	11.1	5.0

Broca's Aphasics' Raw Data-2

Subject ID No.	Sex	Age	Rey. Ost.	Funct. Comm.	Demo No.	Time CDT/Minutes
1	M	67	24.5 III	VERB./GEST.	1	41
2	M	19	24.0 IV	CANNON COM.	1	38
3	F	61	14.0 IV	WRITING	2	37
4	M	34	21.0 IV	VERBAL	1	47
5	M	65	17.5 II	VERBAL	1	80
6	F	48	18.5 IV	VERB./GEST.	1	48
7	F	29	19.5 III	VERB./WRIT.	1	25
8	M	42	14.0 III	VERBAL	1	23
9	M	44	20.5 I	VERBAL	1	25
10	F	66	13.0 IV	COMM. BOARD	1	26
11	F	59	19.5 IV	VERB./WRIT.	1	25
12	F	55	14.0 IV	VERB./GEST.	1	50
13	F	45	18.0 III	VERB./WRIT.	1	29
14	F	65	0.5 V	COMM. BOARD	1	18

Broca's Aphasics' Raw Data-3

Subject	Object Items				Action Items				Object & Action			
ID No.	VR1	VR2	OC1	OC2	VR1	VR2	OC1	OC2	VR1	VR2	OC1	OC2
1	3.00	3.00	4.00	4.00	2.33	2.83	2.33	3.83	2.50	2.91	3.16	3.91
2	3.00	2.83	3.66	3.50	3.00	3.00	3.83	3.83	2.91	3.00	3.66	3.75
3	3.00	2.50	3.83	2.83	1.33	1.00	2.66	1.66	1.83	2.16	2.25	3.25
4	3.00	3.00	4.00	4.00	2.83	2.83	3.50	4.00	2.92	2.92	3.75	4.00
5	3.00	3.00	3.66	3.50	2.16	1.66	2.83	3.16	2.50	2.33	3.25	3.33
6	2.66	2.66	3.50	3.33	2.00	2.00	2.66	2.50	1.66	2.33	2.83	3.08
7	3.00	3.00	3.83	4.00	2.66	2.16	3.83	3.33	2.58	2.83	3.66	3.83
8	1.83	2.00	3.50	3.50	0.66	1.00	2.33	2.16	1.50	1.25	2.83	2.92
9	3.00	3.00	4.00	4.00	2.83	3.00	3.83	3.33	3.00	2.92	3.83	3.92
10	3.00	3.00	3.83	3.83	1.50	1.33	2.00	1.66	2.25	2.16	2.92	2.92
11	2.50	3.00	3.33	3.66	1.33	1.16	2.66	2.16	2.08	1.92	2.92	3.00
12	1.83	2.33	3.00	2.83	0.50	0.50	1.50	1.50	1.42	1.16	2.16	2.33
13	2.50	2.50	3.33	3.50	2.16	2.16	3.33	3.00	2.33	2.33	3.25	3.33
14	0.50	0.16	1.50	1.16	0.00	0.33	2.16	1.00	0.08	0.25	1.08	1.83

Wernicke's Aphasics' Raw Data-1

Subject ID No.	Time Post Onset	Western Aphasia Battery Fluency	Aud.Comp.	Repeat.	Naming	Info. Cont.	A.Q.	Drw. Sub.
15	2 months	10	6.4	2.6	2.8	5	53.6	7.0
16	2 months	5	6.9	6.9	8.0	7	67.6	14.0
17	6 months	8	6.85	4.1	6.6	8	67.1	13.0
18	3 months	8	6.7	6.4	3.6	3	55.4	15.0
19	1 month	7	3.85	1.0	0.6	2	28.9	17.5
20	4 months	5	6.9	7.0	7.0	7	65.8	14.0
21	1 month	8	6.8	5.2	7.1	7	68.2	25.0
22	3 months	5	3.85	5.2	0.8	5	39.7	22.0
23	3 months	6	6.85	1.4	0.7	3	35.9	16.5
24	10 months	7	6.8	1.0	2.4	5	44.4	26.0
25	5 months	9	5.45	3.4	7.5	8	66.7	10.0
26	2 months	7	3.8	0.4	0.0	1	24.4	13.0
27	1 month	8	2.75	3.2	2.2	5	42.3	19.0
28	15 months	8	5.1	0.4	0.6	5	38.2	16.5

Wernicke's Aphasics' Raw Data-2

Subject ID No.	Sex	Age	Rey. Ost.	Funct. Comm.	Demo No.	Time CDT/Minutes
15	M	67	11.0 IV	VERBAL	1	46
16	F	48	16.5 IV	VERBAL	1	31
17	M	64	20.0 II	VERB./WRIT.	1	42
18	F	59	12.5 IV	VERB./WRIT.	2	86
19	F	70	11.5 II	VERB./GEST.	2	24
20	F	67	17.5 IV	VERBAL	1	40
21	F	28	19.0 II	VERB./WRIT.	1	28
22	M	35	19.0 I	VERBAL	1	43
23	F	74	18.0 II	VERB./WRIT.	1	48
24	F	64	21.0 I	VERB./WRIT.	1	20
25	F	77	1.0 I	VERBAL	3	31
26	M	51	11.5 III	VERBAL	1	25
27	M	65	15.5 IV	VERBAL	1	40
28	F	79	13.0 IV	VERB./WRIT.	1	44

Wernicke's Aphasics' Raw Data-3

Subject	Object Items				Action Items				Object & Action			
ID No.	VR1	VR2	OC1	OC2	VR1	VR2	OC1	OC2	VR1	VR2	OC1	OC2
15	2.72	2.20	3.30	3.16	1.30	1.43	1.72	1.50	1.42	1.42	1.85	1.85
16	3.00	2.50	3.66	3.33	1.66	1.16	1.50	2.00	2.33	1.83	2.58	2.66
17	2.16	2.50	3.16	3.33	1.50	0.66	2.33	2.00	1.83	1.58	2.75	2.58
18	2.33	3.16	3.50	2.50	1.33	1.16	1.50	1.16	1.83	1.66	2.50	1.83
19	3.00	3.00	3.83	3.83	1.33	1.66	2.66	3.16	2.16	2.00	3.25	3.50
20	2.00	1.66	2.83	2.50	0.83	1.00	2.16	2.16	1.41	1.30	2.33	2.33
21	3.00	3.00	4.00	3.66	2.00	2.50	2.83	3.50	2.50	2.75	3.41	3.50
22	2.80	3.00	3.00	3.66	1.00	2.50	2.33	2.50	1.91	2.75	2.83	3.08
23	3.00	3.00	3.00	4.00	0.66	1.83	2.00	2.83	1.83	2.25	2.83	3.41
24	2.66	3.00	4.00	3.83	2.33	2.50	2.50	2.83	2.50	2.75	3.25	3.33
25	0.50	0.50	2.00	2.00	0.50	0.16	1.66	2.00	0.50	0.33	1.83	2.00
26	2.50	2.16	2.50	3.66	0.83	1.16	1.66	2.33	1.66	1.50	2.08	3.00
27	2.33	3.00	3.33	3.50	0.66	1.33	2.16	2.83	1.50	2.16	2.75	3.25
28	2.50	2.50	3.50	3.50	1.50	1.16	2.16	2.50	1.83	2.00	3.00	2.50

Global Aphasics' Raw Data-1

Subject ID No.	Time Post Onset	Western Aphasia Battery Fluency	Aud.Comp.	Repeat.	Naming	Info. Cont.	A.Q.	Drw. Sub.
29	9 months	0	2.8	2.4	0.0	0	10.4	13
30	1 month	2	2.15	1.0	0.0	0	10.3	10
31	1 month	0	3.5	0.0	3.1	0	13.2	0
32	2 months	0	0.0	0.0	0.0	0	00.0	5
33	1 month	3	3.9	2.4	5.6	5	39.8	9
34	2 months	0	1.05	0.0	0.0	0	2.1	13
35	2 months	0	1.5	0.0	0.0	0	3.0	3
36	3 months	0	3.9	0.2	0.0	0	8.2	16
37	5 months	0	3.4	0.2	0.2	0	7.6	21
38	1 month	0	2.05	0.0	0.0	0	4.1	55
39	1 month	0	3.25	0.0	0.0	0	6.5	8
40	1 month	3	1.4	0.0	0.0	0	8.8	3
41	2 months	3	1.25	0.0	0.0	0	8.5	6
42	1 month	0	1.3	0.0	0.0	0	2.6	19

Global Aphasics' Raw Data-2

Subject ID No.	Sex	Age	Rey. Ost.	Funct. Comm.	Demo No.	Time CDT/Minutes
29	M	59	12.5 IV	NO SYSTEM	2	46
30	M	69	12.5 V	NO SYSTEM	1	42
31	F	74	4.0 IV	NO SYSTEM	1	72
32	M	67	2.0 V	NO SYSTEM	3	28
33	M	74	7.5 I	NO SYSTEM	1	48
34	M	51	19.0 I	3 SIGNS	1	42
35	M	77	3.5 I	NO SYSTEM	2	37
36	F	72	9.5 IV	NO SYSTEM	2	31
37	F	70	22.0 II	NO SYSTEM	1	58
38	M	69	2.5 IV	NO SYSTEM	2	18
39	M	67	1.5 V	NO SYSTEM	2	33
40	F	77	2.5 II	NO SYSTEM	3	20
41	F	92	5.5 III	NO SYSTEM	1	27
42	F	67	10.0 IV	NO SYSTEM	1	28

Global Aphasics' Raw Data-3

Subject	Object Items				Action Items				Object & Action			
ID No.	VR1	VR2	OC1	OC2	VR1	VR2	OC1	OC2	VR1	VR2	OC1	OC2
29	1.66	1.33	2.16	2.66	0.66	0.83	1.00	1.66	1.08	1.16	2.16	1.58
30	1.83	1.66	2.83	2.33	1.00	1.33	1.33	2.50	1.41	1.50	2.08	2.41
31	0.66	0.66	1.66	2.16	0.83	0.83	2.33	2.50	0.75	0.75	2.41	2.00
32	0.33	0.50	1.33	2.66	0.16	0.33	1.00	1.83	0.25	0.41	1.16	2.25
33	3.00	3.00	3.83	4.00	1.83	1.83	2.83	2.50	2.41	2.41	3.16	3.33
34	3.00	3.00	4.00	4.00	1.33	1.33	2.83	3.16	2.16	2.16	3.41	3.58
35	0.50	0.66	1.50	2.16	0.33	0.16	1.33	1.83	0.41	0.41	1.41	2.00
36	1.16	1.16	2.33	1.83	0.33	0.00	1.66	1.00	0.58	0.75	1.41	2.00
37	2.83	1.66	3.16	2.83	1.00	0.83	2.66	2.50	1.25	1.91	2.66	2.91
38	0.50	0.50	1.50	1.00	0.33	0.16	1.50	1.00	0.41	0.33	1.50	1.00
39	0.66	0.66	1.33	1.50	0.50	0.33	1.33	1.00	0.58	0.50	1.33	1.25
40	0.50	0.50	1.66	2.00	0.00	0.00	1.33	2.16	0.25	0.25	1.50	2.08
41	2.33	2.16	2.83	2.83	0.16	0.33	2.00	1.16	1.25	1.25	2.41	2.00
42	2.00	1.66	3.16	3.00	0.66	1.33	1.83	2.50	1.30	1.50	2.50	2.75

Control Group Raw Data-1

Subject ID No.	Time Post Onset	Western Aphasia Battery						
		Fluency	Aud.Comp.	Repeat.	Naming	Info. Cont.	A.Q.	Drw. Sub.
43	...	...	...	...	...	...	...	...
44	...	...	...	...	...	...	...	...
45	...	...	...	...	...	...	...	...
46	...	...	...	...	...	...	...	...
47	...	...	...	...	...	...	...	...
48	...	...	...	...	...	...	...	...
49	...	...	...	...	...	...	...	...
50	...	...	...	...	...	...	...	...
51	...	...	...	...	...	...	...	...
52	...	...	...	...	...	...	...	...
53	...	...	...	...	...	...	...	...
54	...	...	...	...	...	...	...	...
55	...	...	...	...	...	...	...	...
56	...	...	...	...	...	...	...	...

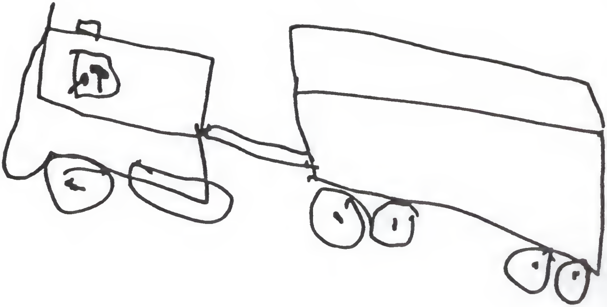
Control Group Raw Data-2

Subject ID No.	Sex	Age	Rey. Ost.	Funct. Comm.	Demo No.	Time CDT/Minutes
43	M	24	31.0 I	⋯	1	16
44	F	44	25.5 III	⋯	1	35
45	M	44	20.0 II	⋯	1	25
46	F	27	21.5 I	⋯	1	11
47	F	31	17.0 II	⋯	1	15
48	F	28	26.0 II	⋯	1	14
49	F	48	20.0 III	⋯	1	19
50	F	44	19.5 II	⋯	1	21
51	F	74	12.5 IV	⋯	1	33
52	M	67	26.0 II	⋯	1	20
53	F	41	19.0 III	⋯	1	30
54	F	34	22.5 IV	⋯	1	11
55	F	63	17.0 III	⋯	1	12
56	M	72	23.5 III	⋯	1	45

Control Group Raw Data-3

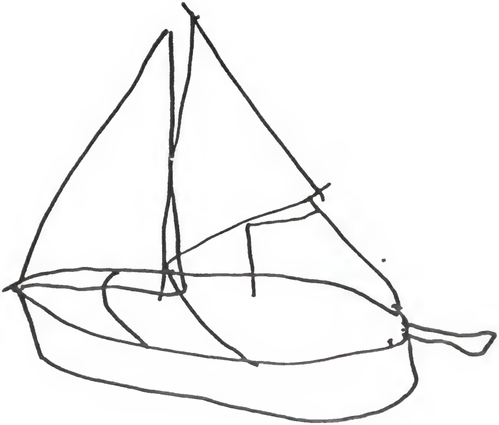
Subject		Object Items				Action Items				Object & Action		
ID No.	VR1	VR2	OC1	OC2	VR1	VR2	OC1	OC2	VR1	VR2	OC1	OC2
43	3.00	3.00	3.83	4.00	2.33	2.16	3.00	2.83	2.91	2.91	2.83	3.66
44	3.00	3.00	4.00	3.33	2.33	2.50	3.00	3.00	2.41	2.41	2.83	3.25
45	3.00	3.00	3.83	4.00	2.33	2.16	3.00	2.83	2.58	2.66	3.25	3.41
46	3.00	3.00	4.00	3.33	2.33	2.50	3.00	3.00	2.66	2.75	3.50	2.83
47	3.00	3.00	3.50	3.66	3.00	2.83	3.83	3.83	3.00	2.91	3.66	3.75
48	3.00	3.00	3.66	3.50	2.50	2.66	3.50	3.66	2.75	2.83	3.66	3.16
49	3.00	2.66	3.66	3.66	2.50	1.66	2.66	2.66	2.75	2.16	3.16	3.16
50	2.50	2.50	3.16	3.16	3.00	3.00	3.16	3.16	2.75	2.75	3.16	3.16
51	2.50	3.00	2.50	3.50	1.66	1.50	2.00	1.83	1.75	2.25	2.25	2.83
52	3.00	3.00	4.00	4.00	2.83	2.16	4.00	3.33	2.91	2.58	4.00	3.66
53	3.00	3.00	3.66	4.00	2.50	2.33	3.00	2.83	2.66	2.75	3.33	3.33
54	3.00	3.00	3.50	3.83	3.00	2.83	4.00	3.83	2.91	3.00	3.83	3.75
55	3.00	3.00	3.83	3.66	2.16	2.16	3.00	3.33	2.58	2.50	3.41	3.50
56	3.00	3.00	3.83	4.00	2.33	2.00	3.16	3.00	2.50	2.60	3.50	3.50

APPENDIX C
SAMPLE DRAWINGS PRODUCED BY SUBJECTS DURING CDT

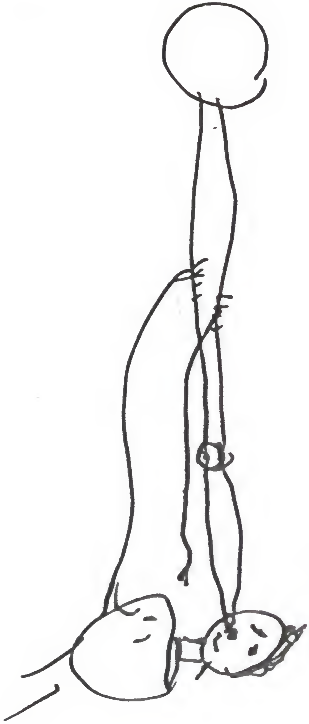


PATIENT ID #52
CONTROL GROUP
DEMONSTRATION ITEM - TRUCK, 18-WHEELER

CDT:	Object	VR1	3.00
	Action	VR1	2.83
	Object & Action	VR1	2.91

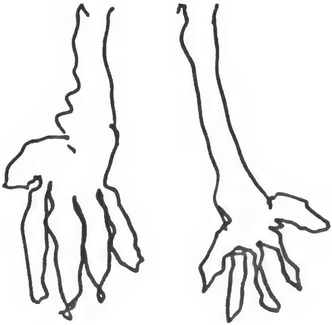


PATIENT ID#52
CONTROL GROUP
TEST ITEM NUMBER 1 - SAILBOAT
CDT: Object VR1 3.00
Action VR1 2.83
Object & Action VR1 2.91



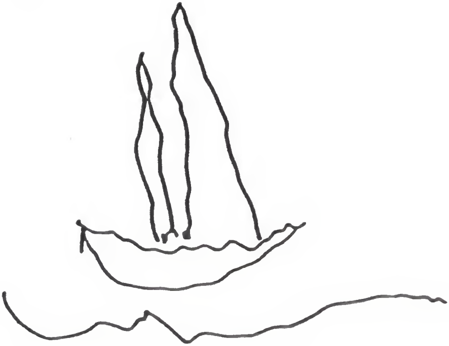
PATIENT ID#52
CONTROL GROUP
TEST ITEM NUMBER 4 - BOY BLOWING A HORN

CDT:	Object	VR1	3.00
	Action	VR1	2.83
	Object & Action	VR1	2.91



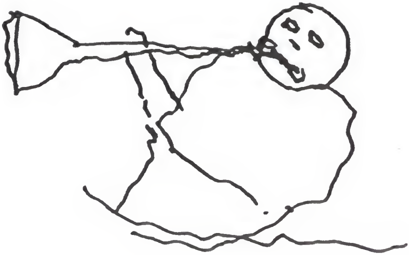
PATIENT ID#51
CONTROL GROUP
DEMONSTATION ITEM - HANDS

CDT:	Object	VR1	2.50
	Action	VR1	1.66
	Object & Action	VR1	1.75



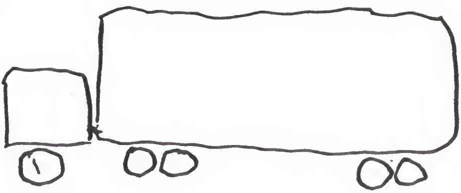
PATIENT ID#51
CONTROL GROUP
TEST ITEM NUMBER 1 - SAILBOAT

CDT:	Object	VR1	2.50
	Action	VR1	1.66
	Object & Action	VR1	1.75

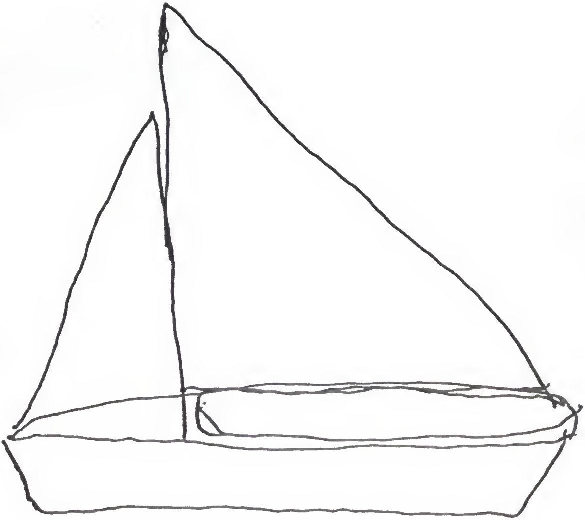


PATIENT ID#51
CONTROL GROUP
TEST ITEM NUMBER 4 - BOY BLOWING A HORN

CDT:	Object	VR1	2.50
	Action	VR1	1.66
	Object & Action	VR1	1.75

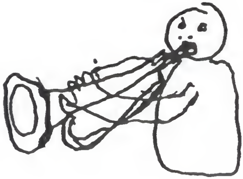


PATIENT ID#4
BROCA'S GROUP
DEMONSTRATION ITEM - TRUCK, 18-WHEELER
WAB A.Q. 55.5
CDT: Object VR1 3.00
Action VR1 2.83
Object & Action VR1 2.92



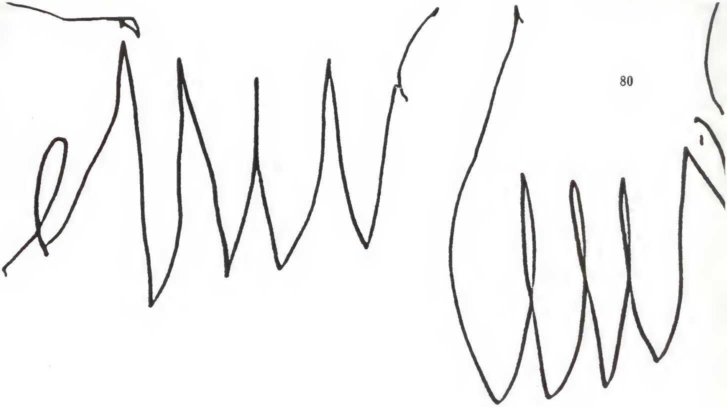
PATIENT ID#4
BROCA'S GROUP
TEST ITEM NUMBER ONE - SAILBOAT
WAB A.Q. 55.5

CDT:	Object	VR1	3.00
	Action	VR1	2.83
	Object & Action	VR1	2.92



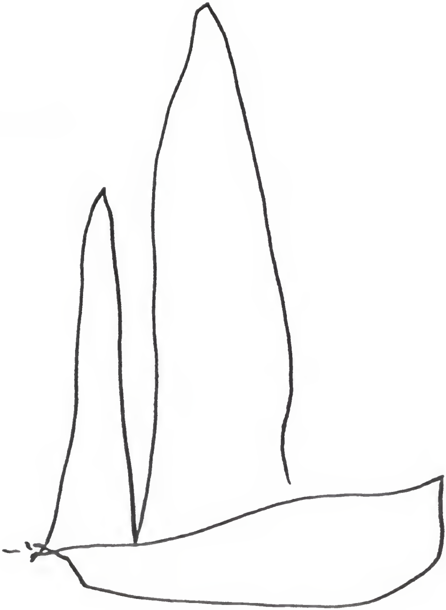
PATIENT ID#4
BROCA'S GROUP
TEST ITEM NUMBER FOUR - BOY BLOWING A HORN
WAB A.Q. 55.5

CDT:	Object	VR1	3.00
	Action	VR1	2.83
	Object & Action	VR1	2.92



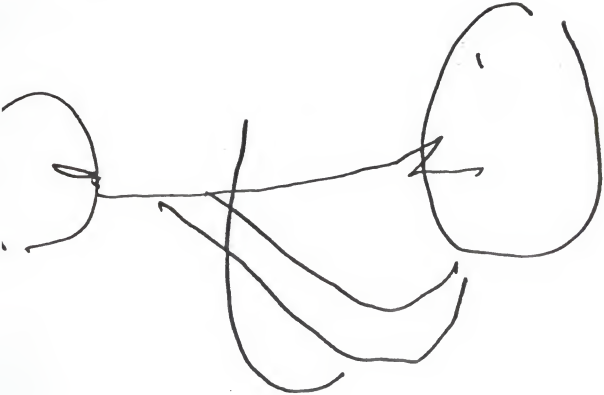
PATIENT ID#12
BROCA'S GROUP
DEMONSTRATION ITEM - HANDS
WAB A.Q. 16.2

CDT:	Object	VR1	1.83
	Action	VR1	0.50
	Object & Action	VR1	1.42



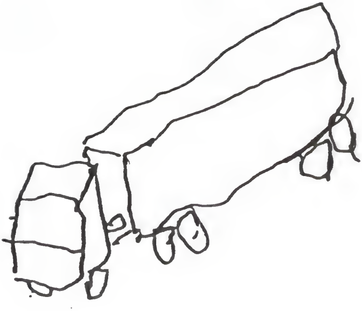
PATIENT ID#12
BROCA'S GROUP
TEST ITEM NUMBER ONE - SAILBOAT
WAB A.Q. 16.2

CDT:	Object	VR1	1.83
	Action	VR1	0.50
	Object & Action	VR1	1.42



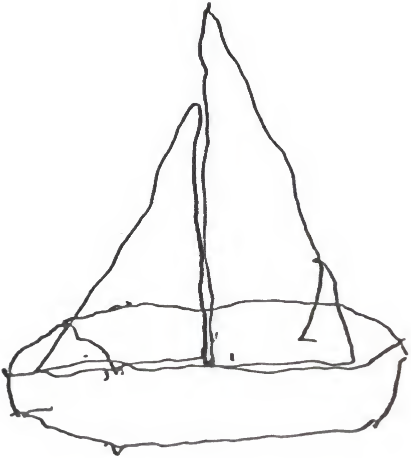
PATIENT ID#12
BROCA'S GROUP
TEST ITEM NUMBER FOUR - BOY BLOWING A HORN
WAB A.Q. 16.2

CDT:	Object	VR1	1.83
	Action	VR1	0.50
	Object & Action	VR1	1.42



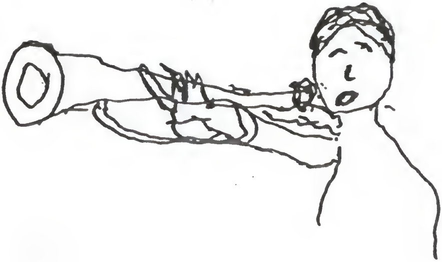
PATIENT ID#21
WERNICKE'S GROUP
DEMONSTRATION ITEM - TRUCK, 18-WHEELER
WAB A.Q. 68.2

CDT:	Object	VR1	3.00
	Action	VR1	2.00
	Object & Action	VR1	2.50



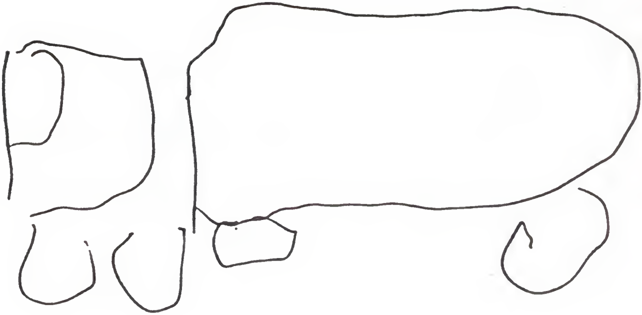
PATIENT ID#21
WERNICKE'S GROUP
TEST ITEM NUMBER ONE - SAILBOAT
WAB A.Q. 68.2

CDT:	Object	VR1	3.00
	Action	VR1	2.00
	Object & Action	VR1	2.50



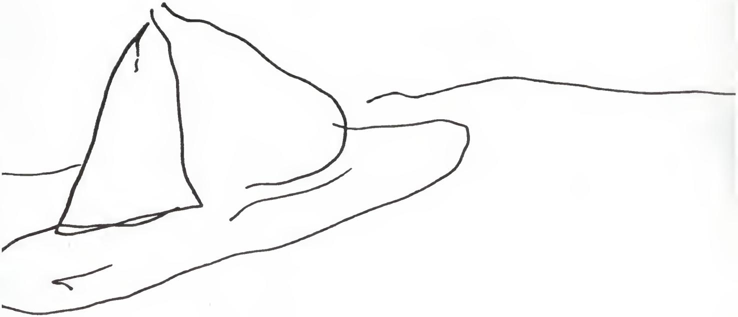
PATIENT ID#21
WERNICKE'S GROUP
TEST ITEM NUMBER FOUR - BOY BLOWING A HORN
WAB A.Q. 68.2

CDT:	Object	VR1	3.00
	Action	VR1	2.00
	Object & Action	VR1	2.50



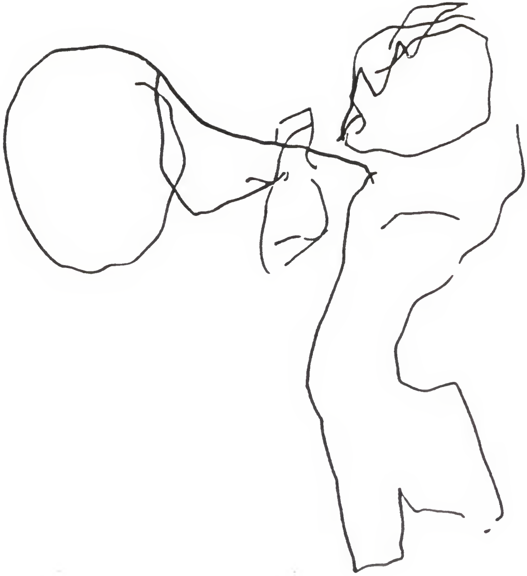
PATIENT ID#26
WERNICKE'S GROUP
DEMONSTRATION ITEM - TRUCK, 18-WHEELER
WAB A.Q. 24.4

CDT:	Object	VR1	2.50
	Action	VR1	0.83
	Object & Action	VR1	1.66



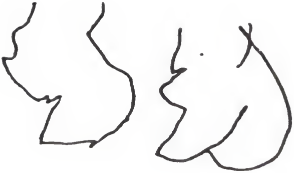
PATIENT ID#26
WERNICKE'S GROUP
TEST ITEM NUMBER ONE - SAILBOAT
WAB A.Q. 24.4

CDT:	Object	VR1	2.50
	Action	VR1	0.83
	Object & Action	VR1	1.66



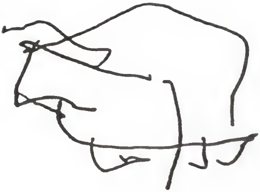
PATIENT ID#26
WERNICKE'S GROUP
TEST ITEM NUMBER FOUR - BOY BLOWING A HORN
WAB A.Q. 24.4

CDT:	Object	VR1	2.50
	Action	VR1	0.83
	Object & Action	VR1	1.66



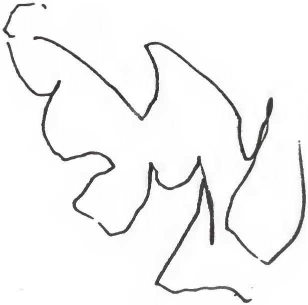
PATIENT ID#39
GLOBAL GROUP
DEMONSTRATION ITEM - HANDS
WAB A.Q. 6.5

CDT:	Object	VR1	0.66
	Action	VR1	0.50
	Object & Action	VR1	0.58



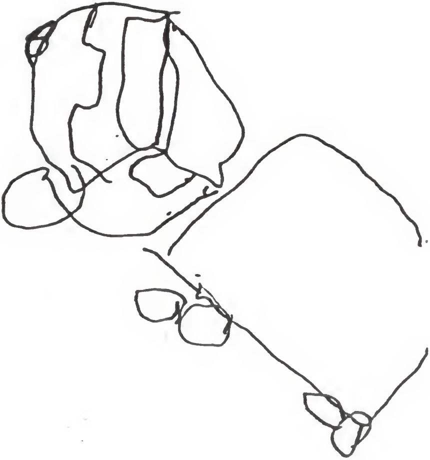
PATIENT ID #39
GLOBAL GROUP
TEST ITEM NUMBER ONE - SAILBOAT
WAB A.Q. 6.5

CDT:	Object	VR1	0.66
	Action	VR1	0.50
	Object & Action	VR1	0.58



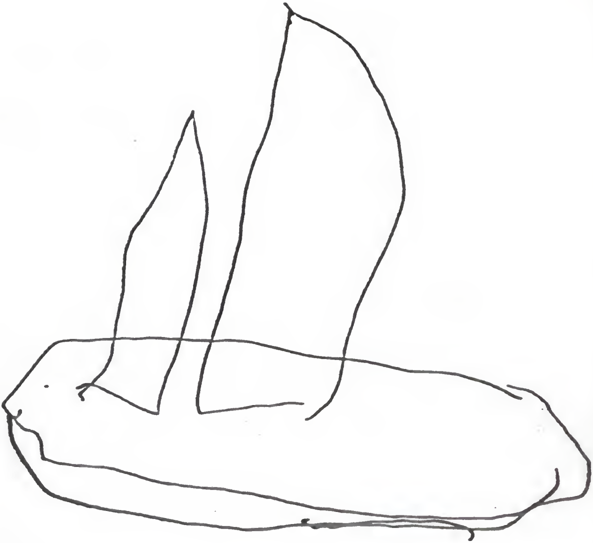
PATIENT ID #39
GLOBAL GROUP
TEST ITEM NUMBER FOUR - BOY BLOWING A HORN
WAB A.Q. 6.5

CDT:	Object	VR1	0.66
	Action	VR1	0.50
	Object & Action	VR1	0.58



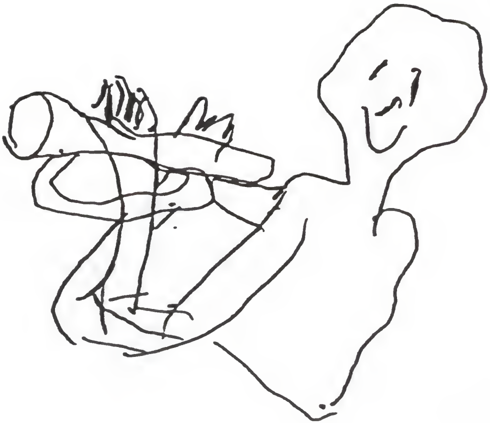
PATIENT ID #34
GLOBAL GROUP
DEMONSTATION ITEM - TRUCK, 18-WHEELER
WAB A.Q. 2.1

CDT:	Object	VR1	3.00
	Action	VR1	1.33
	Object & Action	VR1	2.16



PATIENT ID #34
GLOBAL GROUP
TEST ITEM NUMBER ONE - SAILBOAT
WAB A.Q. 2.1

CDT:	Object	VR1	3.00
	Action	VR1	1.33
	Object & Action	VR1	2.16



PATIENT ID #34
GLOBAL GROUP
TEST ITEM NUMBER FOUR - BOY BLOWING A HORN
WAB A.Q. 2.1

CDT:	Object	VR1	3.00
	Action	VR1	1.33
	Object & Action	VR1	2.16

BIOGRAPHICAL SKETCH

Sandra L. Evans was born on November 17, 1946, in New Orleans, Louisiana, and attended the University of Illinois Demonstration High School in Champaign, Illinois. She graduated in 1960. Upon graduation she entered the Peabody Teachers College in Nashville, Tennessee, but transferred to the University of South Florida in 1962 where she received a master's degree in speech pathology and audiology in 1968.

Sandra then worked in a variety of clinical settings dealing with speech pathology and audiology over the next 11 years. She entered the University of Florida's Ph.D. program in 1979 and expects to graduate in May 1989 with the degree of Doctor of Philosophy.

For the past seven years, Sandra has been employed as Chief of Speech Pathology and Audiology at Tampa General Hospital in Tampa, Florida.

I certify that I have read this study and that in my opinion it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a dissertation for the degree of Doctor of Philosophy.

Linda J. Lombardino

Linda J. Lombardino, Chairman
Associate Professor of Speech

I certify that I have read this study and that in my opinion it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a dissertation for the degree of Doctor of Philosophy.

Thomas B. Abbott

Thomas B. Abbott
Professor of Speech

I certify that I have read this study and that in my opinion it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a dissertation for the degree of Doctor of Philosophy.

Michael A. Crary
Associate Professor of Speech

I certify that I have read this study and that in my opinion it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a dissertation for the degree of Doctor of Philosophy.

Russell M. Bauer

Russell M. Bauer
Associate Professor of
Clinical and Health Psychology

I certify that I have read this study and that in my opinion it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a dissertation for the degree of Doctor of Philosophy.

Randy Carter
Randolph L. Carter
Associate Professor of Statistics

This dissertation was submitted to the Graduate Faculty of the Department of Speech in the College of Liberal Arts and Sciences and to the Graduate School and was accepted as partial fulfillment of the requirements for the degree of Doctor of Philosophy.

May, 1989

Dean, Graduate School